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Infrastructure, environment, buildings

RCRA Facility Investigation Report

Allison Transmission, Inc.

USEPA IDs IND006413348 and IND000806828

February, 2009

ARCADIS

RCRA Corrective Action

RCRA Facility Investigation Report

Allison Transmission, Inc.

USEPA ID Nos. IND006413348 and IND000806828

Prepared for:

General Motors Corporation and Environmental Corporate Remediation Company, Inc.

Prepared by:

ARCADIS U.S., Inc.

ENVIRON International Corporation

Exponent, Inc.

Date:

February, 2009

RCRA Facility Investigation (RFI) Report

List of Updates to RFI Report

Allison Transmission, Inc.

USEPA IDs IND006413348 and IND000806828

TEXT UPDATES

Replace Draft text with Final text in Binder 1 of 2.

'DRAFT' label removed from document.

Date changed from March 7, 2008 to February, 2009 on cover pages.

Footer on all pages now states 'RESUBMITTED FEBRUARY 2009'

Table of Contents updated with the following (bold text indicates changes made):

Drawing 4.27.4	Observed NAPL Thickness – **AOI-19 and AOI-53;**
Drawing 4.43.3	Observed NAPL Thickness– **AOI-26** and AOI-40; and
Table 2.1.1	**Summary of deviations from RFI Work Plans**
Table 3.5.2	**Estimated Cumulative Cancer Risk and HI from Background Metals in Soil**
Table 4.6	NAPL **Data Summary**
Table 5.4	**Comparison of Soil Leal Concentrations to Generic Screening Levels**
Table 5.7	**Screening of Groundwater Concentrations that Could Adversely Affect Surface Water in Big Eagle Creek**
Table 5.8	**Hypothetical Upper-Bound Estimates of** Surface Water **Concentrations** from Groundwater Discharge to Big Eagle Creek
Table 5.9	Upper Bound Estimates of Cumulative Cancer Risk and **HI for Maintenance Worker Exposure to** Smear Zone Soil and NAPL
Table 5.10	Upper Bound Cumulative Cancer Risk and HI for **Exposure** to NAPL Constituents by Vapor Intrusion
Table 6.1	**Summary of Chemicals Detected in Surface Soil Samples from the Wooded Area of AOI 1.**

Appendix I: **Analytical Data Reports for Off-Site Residential Water Wells Sampled by the Marion County Health Department**

Section 1.1: Second paragraph, added text: 'This report documents activities conducted through March 2008.'

Section 2.1: Fourth paragraph, added text: 'This report documents activities conducted through March 2008.'

Section 4.43: Third paragraph is new text: 'Additionally, between 1997 through 2002, MCHD was contacted by five residences to conduct water sampling of their private water well. MCHD collected the water samples from various sample points that included indoor and outdoor faucet locations. MCHD analyzed the water samples for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride) and metals (arsenic, barium, cadmium, chromium, mercury and lead). In addition, MCHD analyzed two of the five water samples from the residences for VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes)'.

Section 4.43.2.2: Toluene in the fourth sentence is now correctly spelled.

First paragraph now includes reference to Appendix I (Analytical Data Reports for Off-Site Residential Water Wells Sampled by the Marion County Health Department). First paragraph uses 'MCL' acronym and removes text spelling out acronym.

Second paragraph is new text: 'Additionally, between 1997 through 2002, MCHD was contacted by five residences to conduct water sampling of their private water wells. MCHD collected the water samples from various sample points that included indoor and outdoor faucet locations. MCHD analyzed the water samples for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride) and metals (arsenic, barium, cadmium, chromium, mercury and lead). Nitrate, nitrite, chloride, sulfate, fluoride, arsenic, barium, chromium, and lead were detected above the laboratory reporting limits; however, the concentrations were below the MCL or the non-enforceable health standards recommended by MCHD for all analytes (analytical results provided in Appendix I). MCHD analyzed two of the five water samples from the residences for VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes). All VOC concentrations were below the laboratory reporting limits.'

Section 5.5.2.1, subsection entitled 'Groundwater', second paragraph includes new text: "Based on these records of historic usage, there are no anticipated circumstances where PW-2 would be the main source of water supply for the plant for a significant duration. The only time that water would be used solely from PW-2 is during maintenance of the west loop. Typically this maintenance would be completed in a matter of days. The west loop is the primary source of water and PW-2 is commonly used only on a limited, emergency basis during maintenance of the west loop. In addition, the water used in the distribution system is recycled throughout the process. Well water is added to the distribution system to make up the necessary volume of water needed for the different uses at the Facility. Typically well water makes up 10% to 30% of the total water usage at the Facility, with the remainder of the water being recycled water. "

Section 6.3: Fifth sentence of the second paragraph now includes proper reference: 'Detected chemicals were compared with EPA Region 5 Ecological Screening Levels (ESLs, www.epa.gov/reg5rcra/ca/ESL.pdf).'

Table NWG-1 is properly referenced as Table 6.1.

Second paragraph, seventh sentence now includes reference to www.epa.gov/ecotox/ecossl/.

Section 7.3: First paragraph, first sentence updates incorrect word from 'through' to 'though'.

Second bulleted item is revised as shown (bold text indicates changes made):

- "To facilitate redevelopment of the Plant 2 property for commercial/industrial reuse, PAHs in soil at AOI 2-2 will be further evaluated."

Fourth bulleted item is new text:

- "To continue operation of the Diesel Fuel Plume Groundwater Recovery System (AOI 40)."

TABLE UPDATES

Replace the following Tables in Binder 1 of 2.

Table 2.1.1: Table 2.1.1 is now included.

Table 6.1: Table 6.1 is now included.

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List of Updates to RFI Report

DRAWING UPDATES

Replace the following Drawings in Binder 2 of 2* or Drawing Roll.

Drawing 1.2.2*: Location for PW-3 is now presented in correct surveyed location. Location MW-0705 is now presented as MW-0705-S2. Location SB-26-0703 is now presented as SB-31-0701. Road name 'Cossett Road' is now presented as 'Cossell Road'. Location MW-0109-S2B is now presented in correct surveyed location. The northern portion of Plant 2 is now presented. The scale is now presented as 1 inch equals 150 feet.

Drawing 3.4.3*: Plant 2 building label replaced with labels entitled 'Extent of Slab'.

Drawing 3.4.5*: Location MW-0624-S3 is now presented as MW-0624-S2. The saturated sand unit previously labeled 'S3' at MW-0624-S2 is now presented as S2. Location MW-0628-S2 is now presented as MW-0628-S2B.

Drawing 3.4.6*: Location MW-0601-S3 is now presented as MW-S3-0601. Location MW-0601-S2A is now presented as MW-S2A-0601.

Drawing 3.4.7*: Location RW-0501-S3 is now presented.

Drawing 3.4.8*: Location MW-0207-S2A is now presented as MW-0207-S2B. The sand unit (18-26 feet below ground surface) at SB-19 previously labeled 'S2' is now presented as 'S2A'.

Drawing 3.4.15*: Screened sand unit (27-36 feet below ground surface) from MW-0634-S2B to MW-0612-S2B previously labeled S2 is now not labeled.

Drawing 3.4.16*: Location MW-0705-S1 is now presented as MW-0705-S2 (groundwater elevation was initially contoured in the 3/5/08 submittal). Location MW-0109-S2B is now presented in correct surveyed location. Big Eagle Creek now shows the USGS topographic elevation of the bottom of the creek above mean sea level. The 692 foot contour has been removed.

Drawing 3.4.17: Location PZ-01-0701 now presents an 'NM' (not measured) for the October 2007 gauging event. Big Eagle Creek now shows the USGS topographic elevation of the bottom of the creek above mean sea level.

Drawing 3.4.18*: Location MW-0629-S3 is now presented along with the 694 foot groundwater elevation contour. Location MW-0109-S2B is now presented in correct surveyed location.

Drawing 3.5.1: Location MW-0703-S2 soil analytical for the 0-2' interval is now presented.

Drawing 4.2.1: Stray circle north of SB-02-02-0703 is now removed. Location MW-0616-S2 symbol is now presented in blue.

Drawing 4.6.1: Location MW-0705-S1 is now presented as MW-0705-S2.

Drawing 4.25.1: Locations MW-0413-S1, MW-12-S1 and MW-0611-S1 are now presented with green symbols (identified as S1 monitoring wells). Location MW-0413-S1 databox column for 3/17/06, presenting 'NS' for all constituents is now removed. Location SB-26-0703 was incorrectly named and is now presented as SB-31-0701.

Drawing 4.27.4: Title is now presented as 'Observed NAPL Thickness – AOI-19 and AOI-53'. Drawing now presents observed NAPL from AOI 19 and AOI 53 (AOI 26 is now removed). The databox for location MW-0413-S1 has been updated: presents data from 2/28/06 through 2/2/07. Symbol 'NP-NM' has been removed from the legend. Drawing no longer presents soil boring locations. Dashed line is included to illustrate observed NAPL locations and presented in the legend.

Drawing 4.31.1: Location names are now presented as follows:

MW-0115 = MW-0115-S1,

IW-0201 = IW-0201-S1

IW-0202 = IW-0202-S1

IW-0203 = IW-0203-S1

Drawing 4.32.2 and 4.32.3: Stray circle located at AOI-33E/AOI 41J is now removed.

Drawing 4.36.1: Location SB-26-0703 was incorrectly named and is now presented as SB-31-0701.

Drawing 4.36.2: Location SB-26-0703 was incorrectly named and is now presented as SB-31-0701.

Drawing 4.36.3: Added databoxes for the following locations: MW-0116-S2, MW-0609-S2B and MW-16-S2. Location SB-26-0703 was incorrectly named and is now presented as SB-31-0701. Location MW-12-S1 and MW-0611-S1 are now presented as green symbols (identified as S1 monitoring wells). Monitoring well locations associated with sand unit S2, S2A and S2B, east and north of AOI 40, are now presented with blue symbols (identified as S2 monitoring wells).

Drawing 4.36.4*: Location SB-26-0703 was incorrect and is now presented as SB-31-0701.

Drawing 4.43.2: Legend and all databoxes are updated to show Diesel Range Organics – Extended Range Organics appropriately.

Drawing 4.43.3: Title is now presented as 'Observed NAPL Thickness– AOI-26 and AOI-40.' Drawing now presents observed NAPL from AOI 26 and AOI 40. NAPL information not previously provided includes the following locations: MW-0631-S1, MW-0632-S2, MW-0709-S2 and MW-S2-0601. Stray '*' removed in AOI 29. Road name 'Cossett' is now presented as 'Cossell'. Databoxes for the following locations are now included: MW-0632-S2, MW-0709-S2 and MW-S2-0601. Data for monitoring well MW-16-S2 has been updated. Drawing no longer presents soil boring locations. Dashed line is included to illustrate observed NAPL locations and presented in legend.

Drawing 4.44.1: Locations for MW-0612-S2B, MW-0613-S2A and MW-0614-S2B are now presented with blue symbols (identified as S2 monitoring wells).

Drawing 4.44.2:

> **PCE in soil 0-4'**: Location SB-33-0604 is now presented with a PCE concentration in soil of 0.0013J. Location SB-0203 is now presented with a PCE concentration in soil of 0.0078. The dashed 0.005 mg/L contour northwest of SB-33-0604 is now presented as solid.
>
> **PCE in soil 8-14'**: Location SB-33-0604 is now presented with a PCE concentration in soil of 0.010J. Location SB-0408 is now presented with a PCE concentration of <0.0051. Location MW-0109-S2B is now presented in correct surveyed location.

PCE in soil 14-20': Location SB-33-0604 is now presented with a PCE concentration of 'R' (rejected).

Drawing 4.50.1*: Leader lines now connect databoxes to correct surveyed soil boring and/or monitoring well locations.

Drawing 4.50.2*: Location SB-0432 is now presented with corresponding databox. Location MW-0109-S2B is now presented in correct surveyed location.

APPENDIX UPDATES

Replace the following Appendices in Binder 2 of 2.

Appendix B: Now presents all RFI boring logs (2006 through 2007) with proper surveyed northing, easting and top of casing elevation. Now presents bookmarks chronologically. Monitoring well construction diagrams for 2004 are updated with construction details.

Appendix I: New Appendix which presents analytical data reports from the Marion County Health Department for off-site residential water wells.

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Tables

Drawings
(All drawings except those noted by an asterisk (*) are included in the roll of drawings.)

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Appendices

Acronyms

1,1,1-TCA	1,1,1-trichloroethane
1,2-DCA	1,2-dichloroethane
ACGIH	American Conference of Government Industrial Hygienists
ADD	Average Daily Dose
AOI	Area of Interest
AS	Air Sparge
ATF	Automatic Transmsision Fluid
ATSDR	Agency for Toxic Substances and Disease Registry
BCa	bias-corrected and accelerated
bgs	Below ground surface
cfs	cubic feet per second
cm/sec	centimeter/second
CSM	Conceptual Site Model
DNAPL	Dense Non Aqueous Phase Liquid
DOCC	Document of Current Conditions Report
ENCORE	Environmental Corporate Remediation Company, Inc.
ERD	Enhanced Reductive Dechlorination
ft	Feet
ft2/d	square feet per day
GM	General Motors Corporation
gpm	gallons per minute
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IM	Interim Measure

IRIS	Integrated Risk Information System
LADD	Lifetime Average Daily Dose
MCL	Maximum Contaminant Level
msl	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NCEA	National Center for Environmental Assessment
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PA/VSI	Preliminary Assessment/Visual Site Inspection
PCE	Tetrachloroethene
PEL	Permissible Exposure Limit
PM10	Particulate Matter smaller than 10 microns
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
REL	Recommended Exposure Limit
RFI	RCRA Facility Investigation
RME	Reasonable Maximum Exposure
S	Storativity
SF	Slope Factor
sqft	Square feet
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
T	Transmissivity

TLV	Threshold Limit Values
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
URF	Unit Risk Factor
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

1 Introduction

1.1 General

The United States Environmental Protection Agency (USEPA) and General Motors Corporation (GM) have entered into a performance-based Resource Conservation and Recovery Act (RCRA) Corrective Action Agreement (Agreement) with the effective date of April 27, 2005. Pursuant to the Agreement, GM has worked in cooperation with USEPA to investigate, and as necessary, stabilize and remediate releases of hazardous wastes or hazardous constituents at or from Allison Transmission (the Facility) located in Indianapolis and Speedway, Indiana (EPA ID IND006413348 for Plants 3 and 12/14, and IND000806828 for Plant 2). In August 2007, GM sold Allison Transmission, which included the Facility, to Clutch Operating Company, Inc. (who now operates the Facility as Allison Transmission, Inc. (Allison)). However, as part of the sale GM retained responsibility for certain existing environmental issues at the Facility, including completing Corrective Action. The Facility and surrounding properties are shown on Drawing 1.1.1. This report was prepared to fulfill the requirements of Section V.1.b in the Agreement.

A Description of Current Conditions Report (DOCC) was prepared by ARCADIS G&M, Inc. (ARCADIS) in July 2005. The DOCC was prepared as one of the initial steps in the RCRA Corrective Action process on behalf of Environmental Corporate Remediation Company, Inc. (ENCORE), a wholly owned subsidiary of GM who is responsible for administering Corrective Action at this Facility. As required by the Agreement, the DOCC discussed the solid waste management units (SWMUs) and areas of concern (AOCs) identified by USEPA in the preliminary assessment and visual site inspections (PA/VSI) (dated September 28, 1993), as well as other areas of interest not identified by USEPA that may require further action. To facilitate future work, SWMUs, AOCs, and the other areas of interest were combined, generally by geographic location, into areas of interest (AOIs). Table 1.1.1 presents each AOI with its corresponding SWMU or AOC, where appropriate, and a description of the AOI and its location. This report documents activities conducted through March 2008.

1.2 Facility Description

The Facility includes six plants, Plants 2, 3, 6, 7, 12 and 14. Plants 3, 6, and 7 are connected and are commonly referred to as Plant 3. Therefore, Plant 3 will be used throughout the remainder of this report to refer to Plants 3, 6, and 7. Additionally, Plants 12 and 14 are connected and will be referred to as Plant 12/14 throughout the

remainder of this report. Drawing 1.1.1 shows the topographic location of the Facility. An aerial view of the site is presented in Drawing 1.2.1. The boundaries of Plant 2, Plant 3 and Plant 12/14 are shown on Drawing 1.2.2. EPA ID Number IND0000806828 is assigned to Allison Transmission for Plant 2 and IND006413348 is assigned to Allison Transmission for Plant 3 and Plant 12/14. The former Plant 12/14 USEPA ID Number IND000806802 is currently assigned to ENCORE for any hazardous waste management activities that ENCORE may experience in carrying out GM's retained environmental responsibilities at the Facility (waste disposal, permits, etc.).

1.2.1 Facility Location

Allison is located in the town of Speedway and the city of Indianapolis, Wayne Township, Marion County, Indiana (Drawing 1.1.1).

Plant 2 is located at 4500 West Gilman Avenue, Speedway, and previously occupied approximately 490,605 square feet (sq ft) of floor space on approximately 20.3 acres. Plant 3 is located at 4700 West 10th Street, Speedway, and occupies approximately 2,176,073 sq ft of floor space on approximately 137.1 acres. Plant 12/14 is located at 901 Grande Avenue, Indianapolis, and occupies approximately 1,016,114 sq ft of floor space on approximately 62.3 acres.

1.2.2 Property Ownership History

It is not known when Allison obtained ownership of the parcels comprising Plant 3 but the initial buildings were constructed in 1939. It is not known when Allison obtained ownership of the parcels comprising Plant 12/14 but the Plant 12 building was constructed in 1976. Construction of the Plant 14 building was completed in 1980.

Plant 2 was the site of a former United States Army base. The exact date when Allison obtained ownership of Plant 2 is unknown but the Plant 2 building was initially built in 1936. From 1973 through 1993, GM owned a parcel north of Plant 2. The parcel was owned by Union Carbide prior to 1973 and GM transferred the parcel to Praxair Surface Technologies (a spin-off from Union Carbide) in 1993. As stated in Section 1.1, in August 2007, GM sold the Facility to Clutch Operating Company, Inc.

As identified in the deed between General Motors and Clutch Operating Company, the following restrictions are placed on the property:

1. Allison shall prohibit all uses of the property that are not compatible with the land use restriction placed on the property in accordance with the Performance Based Corrective Action Agreement between the USEPA and GM

2. Allison shall manage all soils, media and/or debris that are excavated or disturbed on the property by Allison in accordance with all applicable state and federal Environmental Laws

3. Allison shall prohibit the use or construction of wells or other devices to extract groundwater for any domestic potable uses (i.e. drinking, showering, cooking or cleaning)

4. Allison is permitted to use dewatering wells or other devices for maintenance or construction purposes, provided the dewatering, including management and disposal of the groundwater is conducted in accordance with all applicable local, state and federal Environmental laws and does not result in a violation of Environmental Laws

5. Allison shall be permitted to use, and have the use of, groundwater at the property in a manner consistent with current uses of groundwater, and at volumes sufficient to meet Allison's water supply requirements for operations and other current uses of such groundwater , and the Corrective Action shall not conflict or interfere with Allison's use of groundwater at the property

6. Allison shall use commercially reasonable efforts not to unreasonably interfere with the operation of any technology, treatment or other activities engaged in by GM or it's affiliates in accordance with their obligations under the Corrective Action

7. If Allison contemplates actions which will materially interfere with the operation of any technology, treatment or other activities engaged in by GM or it's affiliates in accordance with their obligations under the Corrective Action, Allison shall provide prior notice to GM of it's intent to take such action

8. If Allison intends to transfer any interest in the property, Allison shall provide notice to USEPA and IDEM at least 21 days prior to consummating any such transfer. Allison shall not transfer any interest in the property unless the transferee agrees in writing to comply with the terms and conditions of Section

7 of the Asset Purchase Agreement that are applicable to Allison, and GM is provided the right to enforce such written agreement against such transferee.

1.2.3 Current and Historical Operations

Plant 2 was formerly involved in aircraft engine testing, machining, parts cleaning, and warehousing. An expansion on the north side of Plant 2 was added circa 1969, and was used only for warehouse space to support parts distribution activities. An area south of the warehouse, near the center of the Facility, was renovated circa 1993 as a fitness center for Allison employees. Manufacturing at Plant 2 stopped in the mid-1990s. Machinery and supplies formerly used in plant operations were removed from the Facility prior to demolition. Plant 2 was demolished in 2004 leaving only a partial concrete floor slab with remaining areas of the Facility covered with asphalt or limestone gravel. From 1973 to 1993 GM owned a parcel of land north of Plant 2 and used the parcel for surface parking. This parcel appears to have included all or part of four former lagoons that were owned and operated by Union Carbide up to 1973. The lagoons are visible on aerial photographs between 1941 and 1962 (Appendix A of DOCC). By 1972, two of the lagoons were no longer visible in the aerial photograph and the remaining two lagoons appeared to be in the process of being filled. Ownership of the parcel was returned to Praxair Surface Technologies (a spin-off from Union Carbide) in 1993. A memo summarizing an evaluation of the potential connection of this property to the Plant 2 property is presented in Appendix A.

The initial building of Plant 3 was constructed and began operations in 1939 for aircraft engine production and is currently the main transmission manufacturing Facility as well as administrative headquarters for the company. Plant 6, a portion of Plant 3, was constructed in two phases, the first in 1942 and the second in 1966. Plant 7, another portion of Plant 3, was constructed in 1970. Plants 6 and 7 have always been used for production of transmissions. Plant 12 is used for the manufacture and assembly of automatic transmissions. Plant 14 is used primarily for the production of transmissions under government contract.

Manufacturing processes in Plant 3 and Plant 12/14 have not changed significantly since operations began in 1939 although the location of specific operations may have changed over the years. For example, all manufacturing processes have been moved out of Plant 7 and Plant 7 is used for inventory storage. Allison produces automatic transmissions for large- and small-scale commercial, large off-road commercial and military vehicles. The Facility also conducts research and development activities related to transmissions. Parts produced may require one or more manufacturing

processes including machining, cleaning, plating, immersion coating, heat-treating, painting, assembly and product testing. The assembly process may require that the parts be cleaned with a variety of solvents and lubricated with oil. Following the final assembly, each transmission is tested for quality control purposes, a step that requires transmission fluids and various fuels to be utilized on the Facility. Numerous plating lines and machining lines have been located at the Facility over the years, along with approximately 35 degreasers and/or stills. Most degreasers have been taken out of service or have been converted to water-based cleaning solutions or mineral spirits. Prior to the conversion, the degreasers contained various chlorinated solvents, including 1,1,1-trichloroethane (1,1,1-TCA) and tetrachloroethene (PCE).

The majority of the Facility is covered with either structures or pavement. A grassy area including two baseball diamonds are located to the west of Plant 3 and are used for recreational purposes for UAW softball leagues. Big Eagle Creek is located south of the Plant 3 property and flows northwest-southeast. Little Eagle Creek runs through the eastern portion of the Plant 12/14 property and flows north-south. An overview of the land cover at the Facility is presented in Drawing 1.2.3.

Operations at the Facility are regulated under several environmental laws and regulations, including RCRA, Clean Air Act, Clean Water Act, and Toxic Substance Control Act. In addition, the workplace is regulated under the Occupational Safety and Health Administration (OSHA). Operations at the Facility are not expected to significantly change in the foreseeable future.

1.3 Interim Measures

Interim measures are in place at AOIs 40, 51 and 53. In addition, interim measures were planned at AOI 19 prior to the start of the RFI. A pilot test was performed at AOI 26.

1.3.1 AOI 19 – Waste Treatment NAPL Recovery System

An LNAPL has been observed in monitoring well MW-0413-S2, downgradient from the skim basins at the waste treatment area (AOI 19). Characterization of the LNAPL revealed it was a heavy petroleum product (i.e., lubricating oil or mineral oil) and contained polychlorinated biphenyls (PCBs). During the initial sampling event Aroclor 1248 was detected at 14 mg/kg and during a subsequent re-sampling detected at 31 mg/kg. The proposed design includes a specific gravity skimmer pump and product

storage. A work plan presenting the design was submitted to USEPA on October 13, 2006.

1.3.2 AOI 26 – Oil Reclaim Area Pilot Study

The Oil Reclaim Area historically contained elevated levels of VOCs in the groundwater. In 2002 a pilot study was conducted to determine if the impacted groundwater would be suited for enhanced reductive dechlorination (ERD). Three injection wells (IW-0201, IW-0202 and IW-0203) were installed to deliver the molasses to the saturated sand in the south fuel farm (south of the Oil Reclaim Building). After six months of the pilot study, the trichloroethane and trichlorethene concentrations in the groundwater were reduced by 90 % and 99 %, respectively from the baseline concentrations. Based on the results of the pilot study no further remediation was necessary.

1.3.3 AOI 40 - Diesel Fuel Plume Groundwater Recovery System

The Diesel Fuel Plume Groundwater Recovery System (AOI 40) has been in operation since 1973 and was upgraded to increase efficiency and effectiveness in 2001. A layout of the Diesel Fuel Plume Groundwater Recovery System is presented in Drawing 1.3.1.

Since 2001, approximately 16.8 million gallons of groundwater (approximately 6,900 gallons per day) have been pumped from the nine recovery wells (three recovery wells (BW-4, BW-11 and BW-12) are located near the southern edge of the Plant 3 building and six recovery wells (BW-5, BW-6, BW-7, BW-8, BW-9 and BW-10) are located just north of Big Eagle Creek). In October 2005, the recovery system was further upgraded to allow for removal of LNAPL and pre-treatment of the impacted groundwater and subsequent discharge to the Town of Speedway sanitary sewer system. Prior to October 2005 the recovered groundwater and LNAPL were treated in the Allison waste treatment system and then discharged to the Town of Speedway sanitary sewer system. In October 2007, the recovery system was further modified to better accommodate increased recovery of LNAPL.

Prior to October 2007 the discharge of the pre-treated water had been approved by the Town of Speedway through Industrial Waste Discharge Permit Number 2003-1. As a result of GM's August 2007 sale of Allison, ENCORE applied for and received a permit (Permit Number 2007-3) dated October 1, 2007, from the Town of Speedway to discharge to the Speedway sanitary sewer system.

Since the October 2005 upgrade, when discharge to the Town of Speedway's sanitary sewer system began, approximately 2,563,627gallons of pre-treated groundwater have been discharged. From June 2001 through December 2007, the recovery well system has removed approximately 9,905 gallons of total petroleum hydrocarbons (TPH) as measured by analysis of extracted groundwater.

The groundwater recovery system was not operating properly in June 2000 due to the recovery well screens becoming plugged. As a result of the system not operating properly, a diesel fuel sheen was seeping into Big Eagle Creek. A containment boom was installed in the Big Eagle Creek directly downgradient of AOI 40 to mitigate the sheen. Oil-only absorbent booms are attached to the physical containment boom to capture a sheen that was seeping from the bank of the creek. After the 2001 upgrade, the frequency and significance of observable sheen in the creek steadily decreased. The containment boom is maintained to contain and capture any minimal sheen that does enter the creek.

1.3.4 AOI 51 – Soil Vapor Extraction / Groundwater Recovery System

The Soil Vapor Extraction (SVE) System installed at Plant 12 (AOI 51) for the removal of PCE from shallow soils in the vicinity of the former degreaser area has been operational since October 30, 2003. A layout of the Soil Vapor Extraction (SVE) / Groundwater Recovery System is presented in Drawing 1.3.3. In addition, a dense non-aqueous phase liquid (DNAPL) was observed during installation of a few soil borings and monitoring wells in the vicinity of AOI 51 in 2004. A DNAPL recovery system was installed at the same time as the SVE system. However, no DNAPL was recovered so in February 2005, operation of the DNAPL recovery component of the system was discontinued to allow for the installation of a groundwater recovery and treatment system. Since no DNAPL has been recovered, no chemical analysis has been performed on the DNAPL.

Between October 2003 and December 2007, approximately 12.8 tons of PCE have been removed from soil in the vapor phase. A groundwater recovery system was installed in 2007. the system incorporates five previously existing DNAPL recovery wells (now referred to as source area recovery wells), and one new source area recovery well, and eight downgradient hydraulic control groundwater recovery wells. The downgradient hydraulic control groundwater recovery wells recover groundwater from the S2A, S2B and S3 sand and gravel units. The downgradient recovery wells were started in September 2007 and the source area wells were phased into operation

over the next several months. The treatment system includes a DNAPL separator, bag filters and an air stripper to remove the PCE and its degradation products.

In 2007 (as part of Phase III of the RFI), eight soil borings were advanced to collect soil samples for analysis of volatile organic compounds (VOCs) to evaluate the effectiveness of the system through a comparison of current concentrations to pre-IM concentrations. A comparison of this data is presented in Appendix G of this report. Additionally, the soil data collected in 2007 is used to current concentrations of VOCs in soil (i.e., replace pre-IM soil VOC results) for specific locations and intervals as described in Appendix G.

1.3.5 AOI 53 – Transmission Test Assembly Area

The transmission test assembly area contained two transmission test cells and a transmission fluid recycling vault. The transmission test assembly area has been retooled; however, the transmission fluid recycling vault is still in place but is no longer used. A storm water drain, which traverses east to west beneath the northern half of the former test assembly area, connects the roof drains to the storm water sewer. A release was reported to IDEM on September 12, 2001 when automatic transmission fluid (ATF) was observed on the surface of water discharging to a storm water transfer sump near Column V054. To identify the source of the ATF, Allison contracted to have a video inspection of the storm sewer performed. The inspection identified ATF in the pipe connecting the roof drain at Column V46 to the storm sewer. Based on this finding, Allison performed an exploratory excavation inside the building where the roof drain penetrates the concrete flooring. The excavation revealed that ATF had migrated through a small gap in the concrete and entered the drainpipe at a joint just below the concrete. Approximately one cubic yard of soil containing ATF was removed for disposal, the concrete was replaced and the gap between concrete and drainpipe was sealed. A sample of the virgin ATF was collected in September 2001 and analyzed for BNs. No constituents were detected in the ATF; however, the reporting limits were elevated due to the matrix of the sample.

The ATF release was investigated between September 2001 and February 2004 under the direction of IDEM. Based on the investigation, in February 2003, absorbent socks were installed in monitoring wells MW-0111, MW-0203, and MW-0205, which contained evidence of transmission fluid. Periodically, the absorbent socks are checked and replaced if found to be saturated with product. Per manufacturer's specifications, 12 ounces of the polymer contained in the absorbent socks absorbs approximately a half-gallon of liquid-phase hydrocarbon. The absorbent socks are

visually inspected to determine the approximate saturation in order to determine the gallons of transmission fluid absorbed. Approximately 19.6 gallons of product have been removed since February 2003.

1.4 Report Organization

Section 1 presents the introduction to the report, a description of the Facility (including location, ownership, and operations), and a summary of interim measures in place at the Facility.

Section 2 provides an overview of the RFI, including the RFI approach and objectives, a summary of the AOIs investigated during the RFI, a summary of the pre-RFI data screening, and a summary of RFI field investigations.

Section 3 presents a summary of the surrounding and site-specific hydrogeology and geology, local land use, local water supply sources, and regional climate.

Section 4 presents a summary of the RFI results for each AOI investigated. The summary includes a description of the AOI, the scope of investigation and methodologies used during the investigation, a summary of the RFI data, and a discussion of whether the data collected adequately characterizes the soil and/or groundwater at each AOI. In addition, a summary of the conclusions from the Description of Current Conditions (DOCC) is presented for AOIs 1, 32 and 51.

Section 5 presents the baseline human health risk assessment for the areas investigated at the Facility during the RFI.

Section 6 presents the ecological risk evaluation for the Facility.

Section 7 summarizes the findings and conclusions of the RFI.

Section 8 lists the references cited in this report.

Tables and Drawings referenced in the RFI Report are included at the end of the document. A legend containing pertinent information to aid in the review of the Drawings is presented before the other drawings. The databox Drawings contain data collected prior to and during the RFI.

Appendix A presents a summary of the ownership history of a property (which historically contained four lagoons) located north of Plant 2 and an evaluation of potential utility connections between the property with the lagoons and the Plant 2 property.

Appendix B presents boring logs and well construction diagrams for locations installed prior to and during the RFI.

Appendix C presents the laboratory analytical reports and validation summaries for samples collected during the RFI and summary tables of data collected prior to and during the RFI.

Appendix D presents the *Evaluation of Creek Sediment and Surface Water*, previously submitted to USEPA.

Appendix E presents the Human Health Risk Assessment supporting documentation and calculations.

Appendix F presents the *Ecological Habitat Characterization and Preliminary Conceptual Site Model* previously submitted to USEPA.

Appendix G presents a comparison of PCE concentrations in soil prior to operation of interim measures at AOI 51 with current PCE concentrations to evaluate the effectiveness of the SVE interim measures. Additionally, this presents historical samples that are replaced by RFI samples that are used in the risk assessment.

2 Overview of RFI

2.1 RFI Objectives and Approach

The RFI was conducted in accordance with the RFI Work Plan submitted on November 22, 2005 (ARCADIS, 2005b). The field activities were executed in a phased approach to provide an initial investigation, and subsequent characterization of focused areas. In addition, due to changes in the scope of investigation during the three phases of the RFI, the sampling and analysis matrix was updated to accommodate further site characterization activities at the Facility. Due to access limitations, location of utilities, and other physical limitations, several sample locations were adjusted in the field, which varied from the proposed location presented in the RFI Work Plan. A listing of the sample locations where field adjustments were made and an explanation is provided as Table 2.1.1. Drawing 1.2.2 shows all AOIs at the Facility, and identifies those AOIs where sampling activities were focused during the RFI at the Facility.

The objectives of the RFI were as follows:

- Characterize the nature and extent of known or potential releases of hazardous waste and/or hazardous constituents in environmental media at the Facility;
- Assess potential risk to human health and the environment associated with known or potential releases of hazardous waste and/or hazardous constituents from the Facility;
- Collect sufficient data to support the baseline human health risk assessment, ecological risk evaluation, and RCRA Environmental Indicators determinations;
- Determine whether Interim Measures are necessary to control potentially significant current exposure, if any, to human health or the environment; and
- Determine whether corrective measures are necessary to mitigate potentially significant current and/or future risk, if any, to human health or the environment.

Data collected to characterize potential releases at an AOI were used to support the evaluation of potential current or future exposure at each AOI.

Iron has been analyzed prior to or during the RFI at one or more AOIs at the Facility. Iron is not considered to be a constituent of concern at the Facility. Additionally, arsenic is prevalent in soil and groundwater in central Indiana; therefore, concentrations of arsenic at the Facility may occasionally exceed soil or groundwater screening criteria due to natural arsenic levels. There are no known releases at the Facility that specifically contained arsenic.

Additionally, information obtained during the investigation was used to characterize the geology underlying the site and evaluate groundwater flow direction and gradient. This report documents activities conducted through March 2008.

2.2 Pre-RFI Investigation and Data Screening

As described in the DOCC, a screening evaluation was performed using data collected during investigations previously performed at the Facility. The analytical results were compared to conservative screening criteria to determine the need for additional investigation or evaluation. Based on the results of the screening evaluation, further investigation was proposed in fifty-nine (59) AOIs at the Facility and no further action or investigation was proposed for fourteen (14) AOIs.

The following AOIs were identified in the DOCC as requiring no further action or investigation:

- AOI 2-9 - Process Waste Sump
- AOI 7 - Chip Hopper
- AOI 18 - Dock 37 Construction Debris Storage Area
- AOI 20 - Wastewater Holding ASTs
- AOI 21 - Powerhouse
- AOI 34 - Former Shot Peening Baghouse Area
- AOI 37 - Construction Debris Staging Area
- AOI 39 - Used Oil AST
- AOI 41 - Degreasers not included in other AOIs
- AOI 44 - Copper Strip Area
- AOI 48 - Plant 12 North Trenches
- AOI 49 - Plant 12 South & West Trenches
- AOI 52 - Heat Treat/Stripping Area
- AOI 56 - Miscellaneous Releases Not Associated With an AOI

2.3 Field Investigation

2.3.1 Areas Investigated

The following AOIs were identified in the DOCC Report (ARCADIS, 2005a) and the RFI Work Plan (ARCADIS 2005b) as requiring further investigation:

Plant 2:

- AOI 2-1 - Former UST Area A
- AOI 2-2 - Former UST Area B
- AOI 2-3 - Former UST Area C
- AOI 2-4 - Former UST Area D
- AOI 2-5 - Former UST Area E
- AOI 2-6 - Piston Coolant Trenches and Building
- AOI 2-7 - Former Degreaser Area
- AOI 2-8 - Former Tin Plating Area
- AOI 2-10 - Former UST Area 5

Plant 3 and Plant 12/14:

- AOI 1 - Peninsula Area
- AOI 2 - Baseball Diamond Area
- AOI 3 - Plant 7 Swarf Area
- AOI 4 - Plant 7 West Trench
- AOI 5 - Plant 7 East Trench
- AOI 6 - Dump Station and Hydromation
- AOI 8 - Railroad Spur
- AOI 9 - Waste Resin and Monlan System
- AOI 10 - Dexron System – Plant 7
- AOI 11 - Former Flexible Machining System (FMS)
- AOI 12 - Dexron System – Plant 6
- AOI 13 - Plating, Degreasing and Derust Area
- AOI 14 - West Spill Containment Sump
- AOI 15 - Former Gasoline UST and Remediation System
- AOI 16 - Plant 3 Test cells Spill Containment Sump
- AOI 17 - Test Cell 24 Basement
- AOI 19 - Waste Treatment

- AOI 22 - Paint Booth Sump
- AOI 23 - Dexron System – Plant 3
- AOI 24 - Metal Chip Silos
- AOI 25 - East Spill Containment Sump
- AOI 26 - Oil Stores and Reclaim Area
- AOI 27 - Plating Wastewater Sump
- AOI 28 - Maintenance Garage USTs
- AOI 29 - Plant 3 By-products Area
- AOI 30 - Copper Strip Area
- AOI 31 - Heat Treat Area
- AOI 32 - Department 0384 Plating Area
- AOI 33 - Mop Water Stations
- AOI 35 - Scrap metal Storage Area
- AOI 36 - Drum Storage Building Area
- AOI 38 - AST Farm
- AOI 40 - Diesel Fuel Release
- AOI 42 - Plant 14 Heat Treat Area
- AOI 43 - Plant 14 Cyanide/Copper Plating Area
- AOI 45 - Swarf and Shot Peening Storage Area
- AOI 46 - Department 1207 By-products
- AOI 47 - Spill Containment Sump
- AOI 50 - Henry System
- AOI 51 - Former Degreaser Area
- AOI 53 - Transmission Test Assembly Area
- AOI 54 - Oil Stores/Waste Sump
- AOI 55 - Scrap Metal Collection Hoppers
- AOI 57 - Plant 12 Drum Staging Area
- AOI 58 - Big Eagle Creek Outfalls
- AOI 59 - Little Eagle Creek Outfalls
- AOI 60 - Hydraulic Lift Tanks
- AOI 61 - Henry System
- AOI 62 - Process Water Release Area
- AOI 63 - Process Water Release Area (added to AOI list, Spring 2007)

The first phase of investigation was initiated in January 2006. Field activities were conducted from January 2006 through March 2006. In addition to the field activities investigating the AOIs identified above, soil samples were collected as identified in the RFI Work Plan (ARCADIS 2005b) to characterize background metals concentrations in the soil. These data are discussed and evaluated in Section 3.5. The results from the investigation were submitted to the USEPA in an RFI Data Report (ARCADIS, October 2006a).

An additional sampling event, focused on the sediment and surface water in Big Eagle Creek and Little Eagle Creek, was conducted in June 2006 as part of the first phase of investigation.

Based on results from the Phase I investigation, GM recommended further investigation in the following 28 AOIs to further characterize potential releases. The Phase II investigation was discussed with the USEPA on November 1, 2006 and the Work Plan was documented in the Proposed RFI Phase II Investigation Summary (ARCADIS 2006b):

- AOI 1 - Peninsula Area
- AOI 2 - Baseball Diamond Area
- AOI 6 - Dump Station and Hydromation
- AOI 8 - Railroad Spur
- AOI 9 - Waste Resin and Monlan System
- AOI 13 - Plating, Degreasing and Derust Area
- AOI 16 - Plant 3 Test cells Spill Containment Sump
- AOI 17 - Test Cell 24 Basement
- AOI 19 - Waste Treatment
- AOI 25 - East Spill Containment Sump
- AOI 26 - Oil Stores and Reclaim Area
- AOI 27 - Plating Wastewater Sump
- AOI 29 - Plant 3 By-products Area
- AOI 30 - Copper Strip Area
- AOI 31 - Heat Treat Area
- AOI 32 - Department 0384 Plating Area
- AOI 33 - Mop Water Stations
- AOI 40 - Diesel Fuel Release
- AOI 42 - Plant 14 Heat Treat Area

- AOI 43 - Plant 14 Cyanide/Copper Plating Area
- AOI 46 - Department 1207 By-products
- AOI 47 - Spill Containment Sump
- AOI 53 - Transmission Test Assembly Area
- AOI 57 - Plant 12 Drum Staging Area
- AOI 2-1 - Former UST Area A
- AOI 2-2 - Former UST Area B
- AOI 2-4 - Former UST Area D
- AOI 2-6 - Piston Coolant Trenches and Building

The second phase of investigation was initiated in November 2006. Field activities were conducted from November 2006 through February 2007. The results from the investigation were submitted to the USEPA in an updated RFI Data Report (ARCADIS, 2007a).

Based on results from the Phase II investigation, GM recommended further investigation in 23 of the 28 AOIs investigated during Phase II, (AOIs 17, 25, 29, 47 and 53 did not require further investigation), to further characterize potential releases and collect additional groundwater samples to confirm prior results. The Phase III investigation was discussed with the USEPA on July 20, 2007 and the Work Plan was documented in the RFI Phase III Investigation Summary (ARCADIS 2007b):

3 Environmental Setting

3.1 Facility Location

Plant 2 is bounded by industrial property to the north, including Praxair Surface Technologies (a subsidiary of Praxair, which spun-off from Union Carbide in 1992) north of which is the Indianapolis Motor Speedway; a former railroad right-of-way and Electric Steel Castings Company and 10th Street to the south (beyond which is Allison Plant 3); Main Street to the west (beyond which are commercial/retail facilities and residential properties); and a railroad right-of-way property and lime slurry piles (owned by Praxair), Polco Street and Dry Run Creek to the east. Residential properties are located within one-quarter mile west of Plant 2.

West of Plant 12/14 is Allison Plant 3. A residential area and Plant 2 are present north of Plant 3. Big Eagle Creek borders the Plant 3 southern property boundary, south of which is a public golf course. Directly east of Plant 3 is Plant 12/14. West of Plant 3 are residential and commercial properties.

Plant 12/14 is bounded to the east by Holt Road, beyond which are a commercial Facility, a city park, and a residential area. A residential area is to the south of Plant 12/14. North of Plant 12/14 is a Speedway SuperAmerica gas station and Crystal Clean (an oil and solvent reclaim and industrial degreasing service provider), beyond which is the bulk fuel transfer terminal (Marathon Petroleum Company Speedway Terminal).

3.2 Climate

The Marion County climate is influenced by the Great Lakes and has a continental humid climate. Cool air from Canada collides with warm tropical air to bring changes in the climate within days and creates a variability of the seasons (United States Department of Agriculture 1991).

Frequent weather changes come from the passing of weather fronts and associated low and high centers of air pressure across the region. Winds are typically from the southwest, but during the winter months are dominantly from the northwest. The mean daily temperature is 52.5º Fahrenheit (F) (mcc.sws.uiuc.edu). The lowest mean temperature is in January at 26.5º F. The highest mean daily temperature is in July at 75.4º F (mcc.sws.uiuc.edu). These temperature summary data were collected at the Indianapolis International Airport from 1971 through 2000.

The average total annual precipitation for the county is 40.95 inches (mcc.sws.uiuc.edu). The average annual snowfall is 26.9 inches (mc.sws.uiuc.edu). Data collected for precipitation and snowfall amounts was collected between 1971 through 2000 from the Indianapolis International Airport. Average annual lake evaporation for the area is about 33 inches. The 1-year, 24-hour maximum rainfall is approximately 2.5 inches (United States Department of Agriculture1991).

3.3 Surface Water Hydrology

The approximate Facility elevation is 720 feet above mean sea level; the Facility land surface is relatively flat (less than 10 ft change) and slopes gently to the southwest. The Facility is located in the White River watershed, bounded by one tributary (Big Eagle Creek) to the White River and transected by a second (Little Eagle Creek). Big Eagle Creek, which is located south of the Facility's southern property boundary, flows in an east/southeast direction. The smaller Little Eagle Creek, which flows through Allison property just east of the Plant 12/14 building, flows toward the south and intersects Big Eagle Creek approximately 0.74 miles southeast of the Facility. Dry Run Creek is an intermittent creek that runs north-south along Polco Rd, east of Plant 2, where it then turns east-west along the northern boundary of Plant 12/14 and discharges into Little Eagle Creek. Big Eagle Creek and Little Eagle Creek can be found on the aerial photograph (Drawing 1.2.1).

3.3.1 Big Eagle Creek

Big Eagle Creek, a tributary of the White River, is located in the White River Basin and is one of the principal streams flowing through the outwash aquifer in Marion County (Smith, 1983). Groundwater in the upper saturated sand unit at the Facility flows to the south-southeast and discharges into Big Eagle Creek. Since the construction of Eagle Creek Reservoir was completed in 1968, the flow in the creek has been controlled by the Corps of Engineers who operate the dam for Eagle Creek Reservoir, which is located approximately 4.5 miles upstream from the Facility. The arithmetic mean discharge of Big Eagle Creek (USGS Station 03353500, located at Big Eagle Creek and Lynhurst Drive) as calculated by the United States Geological Survey from 1940 to 1980 is 211 cubic feet per second (cfs), the harmonic mean is approximately 12 cfs, and the 7Q10 is 3.3 cfs. (http://waterdata.usgs.gov/in/nwis/uv/?site_no=03353500&PARAmeter_cd=00065,00060,00010).

Allison has a State of Indiana Industrial NPDES permit for storm water discharge into Big Eagle Creek (permit number INR00A155 and SIC Code Number 3568 – power transmission). The permit includes two stormwater outfalls to Big Eagle Creek (A-3-01 (Outfall 001) and A-3-02 (Outfall 002)) (Drawing 3.3.1).

3.3.2 Little Eagle Creek

Little Eagle Creek, a tributary of Big Eagle Creek, has a drainage area of approximately 17.4 square miles (Town of Speedway, IN, 2005) and is part of the Big Eagle Creek watershed. In the vicinity of the Facility, Little Eagle Creek is a losing stream. Little Eagle Creek joins Big Eagle Creek approximately two miles south of the Facility and several miles above the mouth of the White River (Roberts et al., 1955). Little Eagle Creek originates in northwestern Marion County, just east of Eagle Creek Reservoir and is part of the Big Eagle Creek Watershed. Little Eagle Creek flows southwest where it is joined by Guion Creek and Falcon Creek to the north of the Town of Speedway, and then flows south. The mean discharge of Little Eagle Creek (USGS Station 03353600, located at Little Eagle Creek and 16th Street) from 1966 to 1980 is 24 cubic feet per second (cfs) (http://waterdata.usgs.gov/in/nwis/uv/?site_no=03353600&PARAmeter_cd=00065,00060,00010).

Allison has a State of Indiana Industrial NPDES permit for storm water discharge into Little Eagle Creek (permit number INR00A155 and SIC Code Number 3568 – power transmission). The permit includes one stormwater outfall to Little Eagle Creek (A-12-01 (Outfall 004)) (Drawing 3.3.1).

3.3.3 Dry Run Creek

Dry Run Creek is a tributary to Little Eagle Creek that originates north of Plant 14. The creek runs in a subsurface culvert until the culvert emerges and discharges just northeast of the corner of Polco and 10th Streets. From there the creek runs south under 10th Street and then along the north side of Plant 12, before it joins Little Eagle Creek. In the vicinity of the Facility, Dry Run Creek is a losing stream and is intermittently dry. Allison has a State of Indiana Industrial NPDES permit for storm water discharge into Dry Run Creek (permit number INR00A155 and SIC Code Number 3568 – power transmission). The permit includes one stormwater outfall to Dry Run Creek (A-2-01 (Outfall 003)) (Drawing 3.3.1).

3.4 Geology and Hydrogeology

The Facility is located in Marion County, Indiana, which is contained within the Tipton Till Plain physiographic unit. The topography of this unit resulted from Wisconsinan glacial advances. The regional geology of the area around the Facility consists of approximately 140 feet of alluvial and glacial deposits overlying sedimentary bedrock (Harrison 1963). The Pleistocene glacial drift is characterized by clay tills and stream deposits consisting largely of sand and gravel.

3.4.1 Bedrock Geology

Based on a review of the available boring logs, water supply well records and available literature, the bedrock beneath the Facility is the New Albany Shale of the Devonian System. The New Albany Shale is an evenly laminated, deep brown to black, brittle, pyritiferous shale unit (Harrison 1963). The thickness of the shale is approximately 120 feet thick (Harrison 1963, Fenelon 1994). Regionally, the New Albany Shale has a sharp basal contact with underlying limestone and dolomite units (Jeffersonville Limestone of the Devonian System). In the vicinity of the Facility; however, the shale is encountered at 107 feet bgs and extends to about 190 feet bgs. The shale overlies the Jeffersonville limestone that is found at 190 feet bgs.

3.4.2 Unconsolidated Deposits

The Facility is underlain by a sequence of unconsolidated materials consisting of silt/clay and sand and gravel. According to the United States Department of Agriculture (USDA) *Soil Survey of Marion County*, the soil type at the Facility is classified as Urban land-Fox complex, Urban land-Genesee complex, and cut and fill. The Urban land-Fox complex is described as urban land and well to poorly drained soils. Runoff is generally rapid from the urban land and slow on the Fox soils. The soil type at the Facility is described as having a 0 to 3 percent slope. The Urban land-Genesee complex includes urban land, well-drained soils, and small areas of poorly-drained units with a 0 to 2 percent slope. Runoff is generally rapid on the urban land and slow on the Genesee soils.

Geologic cross-sections and a cross-section reference drawing are presented as Drawing 3.4.1 through 3.4.15. Four sand units separated by clay layers have been identified at the Facility and have been designated Units S1 through S4, with S1 being the shallowest and S4 being the deepest. Unit S1 generally occurs from 1 to 16 ft bgs with a basal elevation ranging from 694 to 715 ft mean sea level (msl). Sand unit S2 is

comprised of sand units from 17.5 ft to 46 ft bgs. This sand unit is identified as S2, S2a and S2b because of the likelihood that these sand units are connected and represent one saturated unit. If there is no clay to divide sand unit S2 into two units (S2A and S2B) then the sand unit is identified as Unit S2 in the RFI. Where present, sand unit S2A generally occurs from approximately 13 to 30 ft bgs with basal elevations ranging from 688.87 to 708.12 ft msl. Because of the relative thickness of sand unit S2A (typically ranging from 6.5-11 ft) and the absence of that unit at several boring locations, it is believed that sand unit S2A is discontinuous and may actually be several distinct, isolated lenses. Sand Unit S2B is apparently the uppermost continuous water-bearing unit and is generally present from approximately 17.5 to 46 ft bgs with a basal elevation ranging from 671.96 to 703.65. When a single sand unit is present beneath an upper confining till unit (confining till generally between approximately 10 and 25 ft bgs), the sand unit is identified as S2B. The clay layers separating Units S1 and S2a, and S2a and S2b are absent near the southern property boundary; therefore, the water-bearing sand unit in that area has been designated Unit S2 as that unit is believed to be part of the uppermost continuous water bearing unit. Sand unit S3 is a deeper water-bearing unit that is present from approximately 48 to 61 ft bgs with a basal elevation ranging from 657.9 to 667.3 ft msl. Sand Unit S4 has been identified in two monitoring wells and two soil borings. S4 is encountered from approximately 88 to 107 ft bgs with a basal elevations ranging from 613 to 620 ft msl.

3.4.3 Facility Hydrogeology

Regional groundwater flow in the shallow saturated zone is generally south towards Big Eagle Creek. A groundwater elevation contour map based on the October 2007 depth to groundwater measurements is presented on Drawing 3.4.15 and illustrates the uppermost groundwater potentiometric surface, which includes groundwater levels from both confined and unconfined groundwater conditions. Groundwater beneath Plant 12/14 appears to be confined (groundwater is encountered in sand units between 25 ft and 35 ft bgs, and the potentiometric surface is approximately 17 ft bgs); however, the overlying confining layer is not present near the southern property boundary; therefore, the groundwater is unconfined in that area. Groundwater in the southern portion of the Facility is generally encountered between 25 and 30 ft bgs. Localized groundwater heterogeneities appear to be present at several areas where the shallow depth to clay may result in the presence of perched groundwater at these locations. The October 2007 groundwater data is consistent with previous data collected at the Site (ARCADIS, 2006a; ARCADIS, 2007a). Drawing 3.4.16 presents the perched groundwater surface at the Facility. Drawing 3.4.17 shows the potentiometric surface of the S3 sand unit, which slopes towards the south. Drawing 3.4.18 shows the

potentiometric surface in the vicinity of the diesel fuel plume recovery wells (AOI 40) south of Cossell Road. Drawings 3.4.19, 3.4.20 and 3.4.21 show the potentiometric surface of sand units S2A, S2B and S3, respectively, in the vicinity of the Former Degreaser Area recovery wells (AOI 51).

Generally, the hydrogeologic characteristics beneath the Facility have been assessed using available published literature and data collected during various aquifer tests (pumping tests) conducted at the Facility. During 1983, the United States Geological Survey (USGS) completed a study of the availability of water from the outwash aquifer beneath Marion County (Smith 1983). The USGS estimated the hydraulic conductivity beneath the Facility would be between 50 and 200 feet per day (ft/day), based on lithologic data.

In 1994, Geraghty & Miller, Inc. conducted slug tests on selected monitoring wells to evaluate the saturated hydraulic conductivity of the shallow aquifer materials (Unit S2). The data collected was analyzed using the Bower and Rice method. The estimated hydraulic conductivity ranged from 2.3×10^{-2} centimeters per second (cm/sec) (66 ft/day) to 3.0×10^{-3} cm/sec (9 ft/day) and was generated by calculating the average of all test results. This hydraulic conductivity suggests well sorted sands and glacial outwash (Fetter, 1994).

In December 2001, a groundwater pumping/soil vapor extraction pilot test was conducted in Unit S1 to evaluate the technology's applicability in addressing volatile organic compound (VOC) impacts to soil and groundwater in the vicinity of the Oil Stores and Reclaim Area (AOI 26). Based on aquifer analysis, hydraulic conductivity (1.0×10^{-2} cm/sec) was calculated using the Theis non-equilibrium method. This value, which is within the range of a fine to medium coarse sand, is consistent with the aquifer sediments (Study 2).

In December 2002, a step drawdown test was performed in Unit S2 to evaluate the physical characteristics of the aquifer near the southern property boundary (AOI 40). The data collected was analyzed using Theis' non-equilibrium formula, Cooper and Jacobs' approximation of the Theis formula and the distance drawdown method. Based on the evaluations, the storativity (S) and transmissivity (T) were calculated to be 0.0076 and 1,120 gallons per day per foot, respectively. The approximate hydraulic conductivity was 1.5×10^{-2} cm/sec (41 ft/day) (Study 3).

A combined pumping/soil vapor extraction (SVE) test was performed in both Unit S1 and Unit S2A at the Former Degreaser Area (AOI 51) on June 7, 2002. The data

collected was analyzed using AQTESOLV© aquifer test analysis software. Based on analysis, the average hydraulic conductivity in unit S2A was calculated to be approximately 3.03 x 10^{-4} cm/sec, which corresponds to silt, sandy silts, clayey sands and till (Study 4, Fetter 1994).

Using historic groundwater level data, the hydraulic gradient beneath the Facility has been estimated to be between 0.00005 and 0.023. Hydraulic conductivity values calculated from pumping tests described above are 1.0 x 10^{-2} in Unit S1, 3.03 x 10^{-4} in Unit S2A and range from 2.3 x 10^{-2} to 3.0 x 10^{-3} cm/sec in Unit S2. Estimated total volume discharge (per unit width of aquifer) and groundwater flow velocity is calculated and provided in the below table for each abovementioned hydraulic conductivity.

AOI	UNIT	K (cm/sec)	K (ft/day)	Gradient (ft/ft)	q (ft/day)	V (ft/day)
AOI 19	S1	1.00 * 10^{-2}	2.83 * 10^{1}	.009	2.60	6.80 * 10^{-1}
AOI 40*	S2	1.50* 10^{-2}	4.25 * 10^{1}	.023	9.95	2.61
Site**	S2	2.30 * 10^{-2}	6.52 * 10^{1}	.005	3.32	8.69 * 10^{-1}
Site**	S2	3.00* 10-3	8.50	.005	4.33 * 10^{-1}	1.13 * 10^{-1}
AOI 51	S2A	3.03* 10^{-4}	8.58 *10^{-1}	.0000491	4.29 * 10^{-4}	1.12 * 10^{-4}

NOTES:

* - Cossell Road to Big Eagle Creek
**-Site: includes from Plant 2 to Big Eagle Creek
q = Ki; q is the total volume discharge per unit width of aquifer
v = Ki/n
estimated porosity is 37.5%

3.5 Background Soil Concentrations

Background soil samples were collected to characterize naturally occurring levels of metals in soil at the Facility so that background risks and site-related risks for certain potential exposures can be distinguished in the RFI baseline risk assessment. Consistent with the RFI Work Plan (ARCADIS, 2005), samples were collected from eight locations (BK-0601 through BK-0608) where no manufacturing or management of production materials or wastes is known to have occurred. The locations where the background soil samples were collected are shown in Drawing 1.2.2. At each location, one to three samples were collected at various depths between 0.5 to 10 ft bgs. The boring logs and the analytical data for these samples are in Appendix B and C, respectively. A summary of soil analytical results are presented in Drawing 3.5.1.

During review of the background data, the surface sample at locations BK-0601 was identified as having several metal concentrations high enough to be considered statistical outliers and apparently elevated detection limits for metals that were not detected. The boring log for this location indicates the sample may have contained asphalt and surficial fill materials not representative of the native soil at the Facility. Therefore, this sample was removed from the background data set prior to any use of the background data.

The metal concentrations that have been used in the calculation of soil background levels are summarized in Table 3.5.1. This table includes background data from all surface samples, except for the point removed as discussed above. The data from the surficial samples were not significantly different from the data from the other depth intervals. As surficial soil is more likely contacted by most potential receptor populations, this data were used to determine background soil concentrations at the Facility.

The upper confidence limits (UCLs) presented on these tables are nonparametric bias-corrected and accelerated (BCa) bootstrap confidence limits on the mean (Efron and Tibshirani 1998) calculated from 4,000 bootstrap replications and at a 0.05 level of significance. Nonparametric bootstrap statistical limits are more reliable than parametric statistical limits because, unlike parametric limits, they do not rely on assumptions about distribution shapes that are often difficult to justify. Concentrations of metals in soil at or below these UCLs are considered to be within background levels and not site-related; for concentrations higher than these UCLs, the differences between the concentrations and background UCLs are considered site-related in baseline risk assessment calculations of site-related cumulative cancer and noncancer risks for exposure to soil.

Table 3.5.1 summarizes the UCL calculations for site-specific background levels. As shown on this table, no UCLs were calculated for antimony, beryllium, cadmium, mercury, selenium and silver because these metals were infrequently detected or not detected in the site-specific background samples. The concentrations of these metals in natural soil are considered to be below the detection limits, and no background values are subtracted from concentrations when comparing to screening criteria or calculating site-related risks.

Table 3.5.2 presents the estimates of cancer risk and hazard quotient that are associated with these background levels, based on the exposure and toxicity assumptions for exposure to soil discussed in Appendix E. These background levels

of risks are not included in the site-related risk estimates that are discussed in the baseline risk assessment in Section 5.

3.6 Water Supply

3.6.1 Water Supply Survey

A review of the available water well records maintained by the Indiana Department of Natural Resources (IDNR) was conducted to identify any potable or nonpotable water supply wells in the area surrounding the Facility. IDNR classifies wells by their capacity; wells producing less than 70 gallons per minute (gpm) are classified as low capacity wells and wells producing greater than 70 gpm are classified as high capacity wells. The review included both low and high capacity wells within a 1/4-mile radius of the Facility. All available well construction logs were examined.

Records for 36 low capacity wells were identified within a ¼-mile radius of the Facility. The depth of the wells ranged from 40 ft to 270 ft below ground surface (bgs). Seven of the wells were completed in bedrock that was encountered at depths ranging from 80 to 127 ft bgs, and the other 29 wells were completed in unconsolidated sand and gravel. Twenty one of the wells are identified as test wells. Copies of water well records are included in Appendix C of the DOCC. One well is located directly downgradient of the Facility at an abandoned metal working facility; however, the well log was not able to be located. No wells were identified within the path of impacted groundwater flow from the Facility.

Twenty-three high capacity wells are located within one-mile of the Facility. Fifteen of these high capacity wells are/were located at the Facility. These high capacity wells ranged in depth from 57 ft to 121 ft bgs. Bedrock was not encountered in any of the wells. Two of the off-Facility wells are downgradient of the Facility and located south of Big Eagle Creek (see Drawing 6 in the DOCC). Twelve of the wells are associated with Allison Transmission. Six wells are associated with the City of Indianapolis and are located north of the Facility.

Twenty-five water wells were visually identified in the residential neighborhood south of Plant 12/14 (see Drawing 3.6.1). These wells are located sidegradient from groundwater impacted by AOI 40 or AOI 51. Two of these visually identified water wells are within a ¼-mile radius of the Facility and included in the 36 low capacity wells discussed above. One property that was visually identified as having a water well is also connected to the Town of Speedway water utility. It is not known if this property

uses the water well for potable purposes. This property is not being billed for sewer service. All of the visually identified water wells on Drawing 3.6.1 are located within No-Well Zone Area 2, which prohibits the installation of or repair/upgrade to a water well for potable purposes. The No-Well Zone is discussed in Section 3.6.4.

In addition to reviewing available water well records, the Town of Speedway and City of Indianapolis Utilities were contacted to determine the source of residential supply water to the south (downgradient) of Plant 3 and Plant 12/14. It was determined that 24 parcels are not connected to the Town of Speedway or City of Indianapolis water and sewer utilities. The 24 parcels are consistent with the 24 parcels where water wells were visually identified. The locations of these parcels are presented in Drawing 3.6.1. Sixty-three of the parcels that are connected to the Town of Speedway or City of Indianapolis water utility are not being billed for sewer utility service.

3.6.2 Facility Non-Potable Water Supply

The Facility's non-potable water supply has been and is currently from groundwater and stormwater. As identified in the deed restriction discussed in Section 1.2.2, Allison may use groundwater at the property in a manner consistent with current uses of groundwater, and at volumes sufficient to meet Allison's water supply requirements for operations and other current uses of groundwater.

Historically there were three water supply wells at Plant 2 (PW-21, PW-22 and PW-23) and twelve water supply wells present at Plant 3 (PW-1 through PW-12). Currently there are six water supply wells being used. Two water supply wells at Plant 2, PW-22 and PW-23, were abandoned in 2003. It is not known when PW-21 was abandoned, but a reconnaissance in 2007 indicated that it was not present. Water supply well PW-1B was taken out of service in 2006. A summary of the production well operational data is presented in Appendix H. In 2006, groundwater production from each of the operating wells was as follows:

- PW-2: 629,000 gallons.
- PW-5A: 0 gallons.
- PW-7A: 18,632,000 gallons.
- PW-10: 0 gallons.
- PW-11: 38,686 gallons.
- PW-12: 17,447 gallons

Extracted groundwater from all these wells is combined and treated to oxidize iron and sand filtration used for turbidity and solids removal prior to use. Supplemental treatment consisting of acid addition, chlorination, and biocide addition is performed prior to groundwater storage in the cooling towers. The treated groundwater is used at the Facility solely for production purposes (cooling towers, boilers, etc.) and non-potable purposes (fire protection).

The stormwater collection basins for the Facility are an additional non-potable water source. During rain events, stormwater is diverted to collection basins. Some of this collected stormwater is treated through sand filters at waste treatment (AOI 19) and is supplied to the Facility for production purposes. The remaining stormwater is discharged to Big Eagle Creek, Little Eagle Creek, or Dry Run Creek through the permitted outfalls.

3.6.3 Facility Potable Water Supply

Plant 3 and Plant 12/14 use city-supplied water for potable purposes. Water was disconnected at Plant 2 prior to demolition. Current and future use of groundwater anywhere at the facility for domestic potable uses (i.e. drinking, showering, cooking or cleaning) is prohibited through the deed of sale as discussed in Section 1.2.2.

3.6.4 Designated Well Areas

Based on communication with the City of Indianapolis Department of Metropolitan Development, the Facility is not located within a well field protection district. The nearest well field protection area (5-year time of travel) is located approximately one half mile to the east-northeast (side gradient) and one quarter mile to the northwest (upgradient) of the Facility. Drawing 3.6.2 shows the area included in the well field protection areas.

Installation of a well in Marion County requires a licensed water well driller to obtain a well permit, which is signed by the Marion County Health Officer. The County Health Officer does not sign well permits for potable wells proposed for installation in a “No-Well Zone”, since the groundwater in these areas is not considered suitable for use by humans for drinking, food preparation, washing or other direct human contact (Sec. 18-102 of the Marion County Health Code). A portion of the Facility (Plant 12/14) is within No-Well Zone Area 2, which is presented on Drawing 3.6.3.

3.7 Land Use

The Facility is situated on three properties consisting of Plant 2, Plant 3, and Plant 12/14 in an area zoned for light and heavy industry. The current zoning designation for the Facility and surrounding area is presented on Drawing 3.7.1.

As discussed in Section 2.1.1, the Facility occupies approximately 220 acres on the southeast side of Wayne Township in Marion County, and currently consists of three properties (Plant 2, Plant 3 and Plant 12/14). As documented in the deed of sale, the Site is limited to industrial or commercial use.

The land use patterns at and around the Facility; trends in population and development; the Township's Comprehensive Land Use Plan for this area; and the implications of these factors for future land use at and around the Facility are discussed in the following Sections. The Comprehensive Land Use Plan is depicted in Drawing 3.7.2.

3.7.1 Zoning and Land Use Patterns

Zoning in Wayne Township is divided into 11 districts, which include classes of industrial, commercial, dwelling and other uses. Drawing 3.7.1 shows the zoning districts for the Facility and surrounding area. The zoning districts are defined in the Zoning Ordinance for Marion County, Indiana (http://www.indygov.org/eGov/City/DMD/Planning/Zoning/municode.htm). The majority of the site is zoned as General Industrial; however, the test-track portion of the Facility is zoned as Light Industrial (COI 2006).

The area surrounding the Facility includes the following industrial, commercial, dwelling and special use districts:

North of the Facility: Community Commercial Uses, Light Industrial, and Office Commercial Uses.

East of the Facility: Residential Area.

South of the Facility: Residential Area, Floodway, and Park Area.

West of the Facility: Village and Urban Mixed Use, Residential Area, and Community Commercial Uses.

The diverse range of properties surrounding the Facility, discussed in Section 3.1, is consistent with the current zoning districts. The Wayne Township Comprehensive Plan identifies different areas of the Township as being in various stages of development (COI, 2001). As shown in Drawing 3.7.3, the Facility predominantly lies within a Stage 2 Development Area located in the southwest portion of the northeast corner of Wayne Township. Stage 2 Development Areas are also known as center city revitalization area. A small portion of the Facility (south of Michigan Street and north of Eagle Creek) lies within a Stage 4 Development Area. Stage 4 Development Areas are also known as suburban revitalization area. In the Stage 2 and 4 Development Areas, in which the Facility is located, it is more common for commercial uses to be developed adjacent to or in the middle of residential areas (Wayne Township comprehensive Land Use Plan, 1993). Similarly, heavy industrial/commercial uses are often adjacent to or across from single-family homes (Wayne Township comprehensive Land Use Plan, 1993). Parts of this area developed without the benefit of stringent building codes, zoning, and subdivision regulations, thereby allowing industrial facilities to be located adjacent to industrial properties (Wayne Township comprehensive Land Use Plan, 1993. The development trends and land use plan for the Stage 2 and Stage 4 Development Areas in which the Facility is located are discussed in Sections *3.7.2* and 3.7.3, respectively.

Within the immediate vicinity of the Facility are major transportation corridors, which include major roadways. Tenth Street, which bisects Plant 2 and Plants 3 and 12/14, is a four lane road. Grande Avenue, which bisects Plant 3 and Plants 12/14 and Cossell Road, which borders Plant 3 to the south and west, are secondary truck routes. Although such high traffic transportation corridors are unattractive to residential development, they provide essential support to industrial use of the area at and around the Facility.

3.7.2 Economy, Population and Housing Trends

Wayne Township experienced its largest recorded growth period during the 1960s. Wayne Township's population increased markedly between 1960 and 1970, while the 1990 population in Wayne Township remained similar to the 1970 population. Between 1990 and 1998, the Township's population increased by about 6%. Between 1998 and 2000 the Township's population increased by only 0.30% (http://www.stats.indiana.edu/population/PopTotals/historic_counts_twps.html). Overall, the Township experienced a 34% increase in population between 1960 and 2000. The following shows the population trend in Wayne Township from 1960 to

1998 (COI 1993a, 1999 and http://www.stats.indiana.edu/population/PopTotals/historic_counts_twps.html).

Year	Population	Change	% Change
1960	99,722		
1970	126,234	26,512	27%
1980	122,809	-3,425	-2.7%
1990	125,699	2,890	2.4%
1998	133,300	7,601	6%
2000	133,699	399	0.30%

By comparison, the population growth experienced in Wayne Township between 1960 and 2000 (34%) outpaced that of Marion County (23%) during this same timeframe (http://www.stats.indiana.edu/population/PopTotals/historic_counts_twps.html).

According to the Wayne Township Facilities & Services Needs Assessment, "…given the current growth rates and the limited supply of buildable land, build-out is likely to occur in 20 to 30 years." (COI 1999, p. 6). Build-out population is defined as "the number of people anticipated to be living in Wayne Township in the year when every piece of property has been developed." (COI 1999, p.6). The build-out population for Wayne Township is projected to be 145,000 persons, which would take 20 to 30 years based on the current growth rate. According to the Facilities & Services Needs Assessment (COI 1999, p.6), once build-out is reached, a population loss is likely because of the current national and local trend towards smaller household sizes.

3.7.3 Speedway Redevelopment Plans

The current Comprehensive Plan developed by the Department of Metropolitan Development, includes 10 critical areas within Wayne Township (COI, 2006). The regions are recognized for historical significance and distinct character. As part of the Comprehensive Plan, recommendations have been made to preserve or redevelop the

areas. Two of the designated Critical Areas are located within close proximity to the Facility. Critical Area 3, located to the west of Plant 2, includes Main Street between 10th and 16th Streets. A few recommendations for this area include expanding Indianapolis Motor Speedway related tourist attractions on the east side of Main Street, where the facilities are compatible with existing industrial uses. Development of new residential areas within the area is not recommended due to local industrial history (COI, 2006).

Critical Area 7 is located south of the Facility and across Eagle Creek bordering the south edge of the Facility property. A few recommendations for this area include the restriction of industrial site expansion to areas northwest or northeast of the Rockville Road/Gasoline Alley intersection, and the transformation of the Eagle Creek corridor to a recreational area (COI, 2006).

The Speedway Redevelopment Commission was created by the Speedway Town Council to redevelop blighted areas in Speedway, Indiana. The Commission is working with Allison to redevelop a portion of Plant 2 (Drawing 3.7.4). According to Allison, this may include retail, restaurant, etc. along Gilman Street, which is currently the entrance to the property. There is a plan that may include extending Gilman Street to Polco St to the east. This would involve neighboring property owners making changes to their existing operations. Additionally, the Commission has also proposed creating a trail that would run along Big Eagle Creek from Lynhurst Avenue to Gasoline Alley (Grande Ave).

4 Investigation Results and Discussion

Section 4 discusses the comparison of analytical results from each environmental medium to conservative screening criteria to determine if potential releases to the environment have occurred and if the field investigation adequately characterized these potential releases. The screening criteria for each environmental medium are discussed below.

The soil characterization data are compared with screening criteria derived from the risk-based preliminary remediation goals (PRGs) published by USEPA Region 9 (USEPA 2004), site-specific vapor intrusion criteria, and soil leaching criteria for protection of drinking water sources. USEPA Region 9 calculates its risk-based PRGs using conservative standard default exposure factors for estimating high-end exposure of workers to soil in commercial/industrial settings. These PRGs were adjusted to a target cancer risk of 10^{-5} and a target HQ of 1 to derive the screening criteria. Site-specific vapor intrusion criteria were calculated based on target cancer risk and HQ of 10^{-5} and 1, respectively. The soil leaching criteria were derived using the procedure outlined in USEPA's Soil Screening Guidance (USEPA 1996) and the drinking water criteria discussed below for protection of drinking water sources. Derivation of these criteria is further discussed in Appendix E.

The groundwater monitoring data are compared with screening criteria based on maximum contaminant levels (MCLs) established under the Safe Drinking Water Act and equivalent drinking water limits for constituents without MCLs, site-specific groundwater vapor intrusion criteria, and groundwater contact criteria. The equivalent drinking water limits are generic risk-based drinking water concentrations calculated using conservative standard default exposure factors for estimating high-end exposure through daily drinking water consumption, and a target cancer risk and HQ of 10^{-5} and 1, respectively. It should be noted that MCLs and equivalent drinking water limits are designed to be protective of potential exposures through drinking water use and represent highly conservative screening criteria for evaluating groundwater that is not a current or reasonably expected future drinking water supply. The site-specific vapor intrusion criteria are calculated analogous to the soil vapor intrusion air criteria. The groundwater contact criteria are risk-based criteria calculated using exposure factors for estimating exposure of workers who could contact groundwater during occasional construction activities, and a target cancer risk and HQ of 10^{-5} and 1, respectively. Derivation of these criteria is further discussed in Appendix E.

Borehole water samples were collected from some soil borings that extended into the saturated zone to assist in the assessment of potential groundwater impact and in the placement of groundwater monitoring wells. Although the procedures for collecting borehole water samples were intended to minimize the potential for introducing contaminants (including soil particles) into the sample by the sampling procedure itself, such influence could not be entirely eliminated because of the nature of the sample collection method. As such, the borehole water data do not necessarily represent groundwater quality in the saturated zone or the groundwater quality over the saturated thickness of the water-bearing zone. Therefore, these data do not provide sufficient bases for identifying the presence of a potentially significant release and are not appropriate for use in the risk assessment. However, these data are compared with the conservative screening criteria described above for groundwater to provide another point of reference**.**

A potentially significant release at an area is identified when the highest concentrations of constituents detected in soil or groundwater at the area are higher than any relevant screening criteria. The presence of constituent concentrations higher than these screening criteria does not mean that the media necessarily poses a significant risk; it only means that the potential to pose a significant risk should be further evaluated considering additional site-specific factors.

All AOIs discussed in Section 4 are evaluated in the human health risk assessment (Section 5) and the ecological risk screening (Section 6), for AOIs identified as potential ecological habitat.

Note that the databox drawings display all data for constituents with concentrations that exceed the criteria discussed above, except the following constituents were excluded to allow more effective use of the figures:

- constituents with concentrations that exceed criteria in only borehole water samples; and,
- constituents that are believed to be unrelated to the Facility and/or were detected only infrequently at low levels.

4.1 AOI 2-1 – Former UST Area A

The Former UST Area A is located in a courtyard near the center of the former Plant 2 building. AOI 2-1 included a total of 16 former USTs and two former sumps that were not identified by the USEPA in the PA/VSI. AOI 2-1 is located outdoors and is covered

with gravel. The building surrounding AOI 2-1 was demolished in the summer/fall of 2004. In addition, a portion of the surrounding concrete slab was removed. The location of AOI 2-1 is shown on Drawing 1.2.2. Additional information on AOI 2-1 is presented in Section 5.63 of the DOCC. The risk-based screening of pre-RFI data for this AOI, as presented in the DOCC, showed that arsenic, benzo(a)pyrene and mercury concentrations in soil exceeded the industrial soil contact criteria. The pre-RFI data also showed that arsenic, chromium (total), cis-1,2-DCE, lead, TCE, and vinyl chloride had concentrations in groundwater at this AOI that exceed the drinking water criteria.

4.1.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-1 included the installation of monitoring well MW-0615-S2 and the collection of groundwater samples from monitoring wells MW-6-S2, and MW-0615-S2. The intent of the groundwater sampling event was to characterize VOCs and metals in the groundwater. Soil borings were not proposed during Phase I because the pre-RFI data that exceeded screening criteria were thought to be associated with soil that was excavated. However, additional investigation into the pre-RFI data during Phase I determined that these data were actually confirmation samples and represent soil that is still at the AOI. Therefore, during Phase II of the RFI, three soil borings were proposed (SB-02-01-0601 through SB-02-01-0603) to characterize sidewall samples that were collected during prior UST removal/excavation activities. Soil boring SB-02-01-0601 (the purpose of the boring was to further characterize mercury identified in a sidewall sample collected during UST closure activities), was inadvertently not installed during Phase II field work and was inadvertently not discussed during the planning of Phase III. Monitoring well MW-0640-S2 was installed to replace monitoring well MW-6-S2. Monitoring well MW-6-S2 was damaged during demolition activities and was abandoned on February 22, 2007. During Phase III of the RFI, a groundwater sample was collected from MW-0640-S2. The locations of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.1.2 Discussion of Results

4.1.2.1 Soil Investigation

Two soil borings (SB-02-01-0602 and SB-02-01-0603) were advanced in AOI 2-1 to characterize sidewall samples that were collected during prior UST removal/excavation

activities. Two soil samples were collected from approximately 1 ft to 2 ft and 8 ft to 10 ft bgs from soil boring SB-02-01-0602 and from 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs. Soil samples from SB-02-01-0602 were analyzed for arsenic and soil samples from SB-02-01-0603 were analyzed for BNs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.1.1 and 4.1.2.

4.1.2.2 Water Investigation

During Phase I of the RFI, monitoring well MW-0615-S2 was installed and subsequently sampled to evaluate potential VOCs and metals concentrations in groundwater upgradient of AOI 2-1. Monitoring well MW-6-S2 was to be sampled during Phase I; however, during demolition activities in the area, this monitoring well was damaged. As a result of the damaged well, a groundwater sampling pump became lodged in the monitoring well during Phase I of the RFI. Monitoring well MW-6-S2 was subsequently abandoned on February 22, 2007. A groundwater sample was collected from MW-0615-S2 for VOCs and arsenic, mercury and total chromium analyses. Hexavalent chromium was not analyzed due to the concentration of total chromium being below the groundwater screening criteria. Analytical results from the groundwater samples collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.1.1 and 4.1.2.

During Phase II of the RFI, one monitoring well MW-0640-S2 was installed to replace monitoring well MW-6-S2. A groundwater sample was collected from monitoring well MW-0640-S2 and analyzed for VOCs, arsenic and total and hexavalent chromium. Analytical results from the groundwater sample collected indicate that TCE and vinyl chloride were detected at concentrations above drinking water criteria. The vinyl chloride concentration was only detected in the field duplicate and not in the parent sample for MW-0640-S2.

During Phase III of the RFI, monitoring well MW-0640-S2 was sampled to verify results observed during Phase II of the RFI. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected indicate that TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.1.1 and 4.1.2.

4.1.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-1. TCE and vinyl chloride were the only constituents detected above the drinking water criteria in the AOI. Downgradient from AOI 2-1, TCE and vinyl chloride are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-1.

4.2 AOI 2-2 – Former UST Area B

The Former UST Area B was located outside of the western portion of the southern wall of the former Plant 2 building, east of the Former Degreaser Area (AOI 2-7). The location of AOI 2-2 included a total of four USTs and three sumps that were not identified by the USEPA during the PA/VSI. AOI 2-2 was located outdoors and is covered with concrete and gravel. The building surrounding AOI 2-2 was demolished in the summer/fall of 2004. In addition, a portion of the concrete slab was removed. The location of AOI 2-2 is shown on Drawing 1.2.2. Additional information on AOI 2-2 is presented in Section 5.64 of the DOCC.

4.2.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-2 included the advancement of soil boring SB-02-02-0601 to characterize arsenic concentrations that had historically been detected along the west sidewall of former UST #20. In addition, the scope included the collection of a groundwater sample from monitoring well MW2-2-S2 to evaluate water quality in the vicinity of AOI 2-2. During Phase II of the RFI, the advancement of two soil borings (SB-02-02-0602 and SB-02-02-0603) was completed to characterize arsenic concentrations that had historically been detected along the west sidewall of former Sump 3 and arsenic and BN concentrations that had historically been detected along the northern extent of the excavation. Additionally, the installation of monitoring well MW-0641 was planned to replace existing monitoring well MW2-2-S2; however, this was not completed as monitoring well MW2-2-S2 was determined to be in good condition and fit for sampling. During Phase III of the RFI, two soil borings (SB-02-02-0702 and SB-02-02-0703) were advanced to further characterize arsenic identified during Phase II of the RFI. Additionally, the advancement of soil boring SB-02-02-0701 was completed to more closely bound the VOC concentrations in groundwater upgradient of AOI 2-2. The locations of the soil

borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and monitoring well were completed in accordance with the RFI Work Plan (November, 2005).

4.2.2 Discussion of Results

4.2.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-02-0601 was installed in AOI 2-2 to characterize arsenic soil concentrations that had historically been detected along the west sidewall of former UST #20. Two soil samples were collected from soil borings SB-02-02-0601 at 0 ft to 2 ft and 8 ft to 10 ft bgs. Soil samples were analyzed for arsenic. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.2.1 and 4.2.2.

During Phase II of the RFI, soil borings SB-02-02-0602 and SB-02-02-0603 were advanced to characterize arsenic soil concentrations that had historically been detected along the west sidewall of former Sump 3 and arsenic and BN concentrations that had historically been detected north of the former excavation. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil boring SB-02-02-0602; and 0 ft to 2 ft, 2 ft to 4 ft, 4 ft to 6 ft, and 6 ft to 8 ft bgs from soil boring SB-02-02-0603. The soil samples collected during the installation of soil boring SB-02-02-0602 were analyzed for arsenic. Soil samples from soil boring SB-02-02-0603 were analyzed for arsenic and BNs. Analytical results from the soil samples collected indicate that arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and dibenz(a,h)anthracene were detected at concentrations above the industrial soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.2.1 and 4.2.2.

During Phase III of the RFI, two soil borings SB-02-02-0702 and SB-02-02-0703 were advanced to further characterize results from Phase II of the RFI. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil boring SB-02-02-0702; and from 0 ft to 2 ft, 2 ft to 4 ft, 4 to 6 ft and 6 ft to 8 ft bgs from soil boring SB-02-02-0703. The soil samples from soil boring SB-02-02-0702 were analyzed for arsenic. The soil samples from soil boring SB-02-02-0703 were analyzed for BNs. Analytical results from the soil samples collected indicate that benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene were detected at concentrations above the industrial soil screening criteria.

A summary of soil analytical results are presented in Table 4.1 and Drawings 4.2.1 and 4.2.2.

4.2.2.2 Water Investigation

During Phase I of the RFI, one monitoring well MW2-2-S2 was sampled to evaluate water quality in the vicinity of AOI 2-2. A groundwater sample was collected and analyzed for VOCs. Analytical results from the groundwater sample collected indicate vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.2.1.

During Phase II of the RFI, a groundwater sample was collected from monitoring well MW2-2-S2 to confirm results from Phase I of the RFI. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected indicate vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 1.3 and Drawing 4.2.1.

Between Phase II and Phase III of the RFI, a groundwater sample was collected from monitoring well MW2-2-S2 and analyzed for VOCs. Analytical results from the groundwater sample collected indicate vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.2.1.

During Phase III of the RFI, one soil boring SB-02-02-0701 was advanced to investigate groundwater quality upgradient of AOI 2-2. A borehole water sample was collected from SB-02-02-0701 and analyzed for VOCs. Analytical results from the borehole water sample collected indicate that cis-1,2-DCE was detected at a concentration above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.2.1.

4.2.3 Conclusion

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene were detected at concentrations above the industrial soil criteria within AOI 2-2 during the RFI. Soil concentrations exceeding the industrial soil criteria are bounded by locations at AOIs north and east of AOI 2-2. Cis-1,2-DCE and vinyl chloride were the only constituents detected above the drinking water criteria in

the AOI. Downgradient from AOI 2-2, cis-1,2-DCE and vinyl chloride are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-2.

4.3 AOI 2-3 – Former UST Area C

The Former UST Area C was located along the south wall of Plant 2, due south of AOI 2-1. The location of AOI 2-3 included two USTs, a hot well and a metal chip hopper that were not identified by the USEPA during the PA/VSI. AOI 2-3 is located outdoors and is covered with concrete and gravel. The building surrounding AOI 2-3 was demolished in the summer/fall of 2004 but the concrete slab in this area remains. The location of AOI 2-3 is shown on Drawing 1.2.2. Additional information on AOI 2-3 is presented in Section 5.65 of the DOCC.

4.3.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-3 included the collection of a groundwater sample from monitoring well MW2-3-S2 to evaluate water quality in the vicinity of AOI 2-3. The location of the monitoring well MW2-3-S2 is illustrated on Drawing 1.2.2. Monitoring well MW2-3-S2 was sampled in accordance with the RFI Work Plan (November, 2005). Soil samples collected during the UST closure activities did not indicate soil concentrations exceeding the soil screening criteria.

4.3.2 Discussion of Results

4.3.2.1 Water Investigation

During Phase I of the RFI, monitoring well MW2-3-S2 was sampled to evaluate water quality in the vicinity of AOI 2-3. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.2.1 and 4.2.2.

4.3.3 Conclusion

No constituents were detected during the RFI above the groundwater screening criteria in AOI 2-3. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at AOI 2-3.

4.4 AOI 2-4 – Former UST Area D

The Former UST Area D was located along the east side (running north to south) of Plant 2. The location of AOI 2-4 included a total of 11 USTs and was not identified by the USEPA during the PA/VSI. AOI 2-4 is located outdoors and is covered with concrete and gravel. The building surrounding AOI 2-4 has been demolished but the concrete slab in this area remains. The location of AOI 2-4 is shown on Drawing 1.2.2. Additional information on AOI 2-4 is presented in Section 5.66 of the DOCC.

4.4.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-4 included the installation of two monitoring wells (MW-0616-S2 and MW-0617-S2) to evaluate water quality upgradient of AOI 2-4 and to replace MW-3-S2, respectively. Monitoring well MW-3-S2 was abandoned on February 22, 2007 because it had historically received infiltration of surface water from ponding that frequently occurs in this area. Monitoring well MW-4-S2 was scheduled for sampling during Phase I of the RFI; however, monitoring well MW-4-S2 was destroyed during the demolition activities and could not be located. Phase II of the RFI included the advancement of two soil borings (SB-02-04-0601 and SB-02-04-0602) and hand auger (SB-02-04-0603), installation of monitoring well MW-0642-S2 to replace monitoring well MW-4-S2 and the collection of groundwater samples from monitoring wells MW-0642-S2 and MW-0616-S2. (The soil borings were not completed during Phase I because the data was overlooked during the initial screening of pre-RFI data.) The locations of soil borings SB-02-04-0602 and SB-02-04-0603 were not located correctly during Phase II of the RFI; therefore, during Phase III of the RFI, soil boring SB-02-04-0701 was advanced to replace SB-02-04-0602 and hand auger SB-02-04-0702 was advanced to replace SB-02-04-0603. The locations of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.4.2 Discussion of Results

4.4.2.1 Soil Investigation

Soil borings SB-02-04-0601 and SB-02-04-0602 and hand auger SB-02-04-0603 were advanced in AOI 2-4 to characterize arsenic soil concentrations that had historically been detected in sidewall samples collected during UST closure activities. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil borings SB-02-04-0601 and SB-02-04-0602; and from 0 ft to 2 ft bgs from hand auger SB-02-04-0603. All soil samples were analyzed for arsenic. Analytical results from the soil samples collected indicate that arsenic was detected at a concentration above the migration to groundwater soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.4.1.

During Phase III of the RFI, soil borings SB-02-04-0701 and SB-02-04-0702 were advanced to replace soil borings SB-02-04-0602 and SB-02-04-0603. Soil samples were collected from 4 ft to 5 ft, 8 ft to 10 ft and 14 ft to 15 ft bgs from soil boring SB-02-04-0701 and from 0 ft to 2 ft bgs from soil boring SB-02-04-0702. All soil samples were analyzed for arsenic. Analytical results from the soil samples collected indicate that arsenic was detected at a concentration above the migration to groundwater soil screening criteria; however, the concentration decreases moving from the AOI; therefore, no additional sampling is necessary. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.4.1.

4.4.2.2 Water Investigation

During Phase I of the RFI, monitoring wells MW-0616-S2 and MW-0617-S2 were installed to characterize groundwater quality upgradient of AOI 2-4 and to replace monitoring well MW-3-S2, respectively. Monitoring well MW-3-S2 had historically received infiltration of surface water from ponding that frequently occurs in this area. This ponding has the potential to cross-contaminate groundwater monitored by MW-3-S2 and could have potentially caused historical detections of BNs in the monitoring well. Groundwater samples were collected from MW-0616-S2 and MW-0617-S2 and analyzed for VOCs, BNs and metals. Due to turbidity in the groundwater samples, monitoring wells MW-0616-S2 and MW-0617-S2 were also analyzed for dissolved metals. Analytical results from the groundwater sample collected did not indicate concentrations of VOCs, BNs, and/or metals above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.4.1 and 4.4.2. Concentration contours of TCE, cis-1,2-DCE and vinyl chloride in groundwater at Plant 2 are presented in Drawings 4.1.3, 4.1.4 and 4.1.5, respectively.

During Phase II of the RFI, monitoring well MW-0642-S2 was installed to replace monitoring well MW-4-S2 which was destroyed during the demolition activities and could not be located. Groundwater samples were collected from monitoring wells MW-0642-S2 and MW-0616-S2 and analyzed for VOCs, BNs and metals. Due to turbidity in the groundwater sample, monitoring well MW-0616-S2 was also analyzed for dissolved metals. Analytical results from the groundwater samples collected indicate that arsenic was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.4.1 and 4.4.2.

During Phase III of the RFI, monitoring well MW-0703-S2 was installed to characterize VOCs identified in groundwater downgradient of AOI 2-4. Groundwater samples were collected from MW-0642-S2 and MW-0703-S2. The groundwater sample collected from MW-0642-S2 was analyzed for arsenic and the groundwater sample collected from MW-0703-S2 was analyzed for VOCs. Analytical results from the groundwater samples collected indicate that arsenic and methylene chloride were detected at concentrations above drinking water criteria. Methylene chloride is a common laboratory contaminant and is not considered a constituent that was released at the Facility. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.4.1 and 4.4.2.

4.4.3 Conclusion

Arsenic was detected during the RFI in soil above the migration to groundwater criteria within AOI 2-4. Perimeter soil samples collected from the former UST excavation did not exceed soil screening criteria for arsenic. Arsenic and methylene chloride were the only constituents detected above the drinking water criteria in the AOI. Downgradient from AOI 2-4, arsenic and methylene chloride in groundwater are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-4.

4.5 AOI 2-5 – Former UST Area E

The Former UST Area E was located in the southeast corner of Plant 2, southeast of AOI 2-10. Historically, AOI 2-5 consisted of a UST and sump. AOI 2-5 is located outdoors and is covered with concrete and gravel. The building surrounding AOI 2-5 has been demolished but the concrete slab remains. The location of AOI 2-5 is shown

on Drawing 1.2.2. Additional information on AOI 2-5 is presented in Section 5.67 of the DOCC.

4.5.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-5 included the advancement of soil boring SB-02-05-0601 to evaluate soil quality from the south sidewall of the excavation completed as part of historical UST closure activities. The location of soil boring SB-02-05-0601 is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-02-05-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.5.2 Discussion of Results

4.5.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-05-0601 was advanced in AOI 2-5 to evaluate soil quality from the south sidewall of the excavation completed as part of historical UST closure activities. Two soil samples were collected from soil boring SB-02-05-0601 at 0 ft to 2 ft and 8 ft to 10 ft bgs. Soil samples were analyzed for BNs and metals. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.4.1 and 4.4.2.

4.5.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-5. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at AOI 2-5.

4.6 AOI 2-6 – Piston Coolant Trenches and Building

The Piston Coolant Trenches and Building was located in the central-west portion of the Plant 2 building. AOI 2-6 was located indoors on concrete; however, the building was demolished in the summer/fall of 2004 and the concrete slab has been removed. The area is currently covered with gravel. The location of AOI 2-6 is shown on Drawing 1.2.2. Additional information on AOI 2-6 is presented in Section 5.68 of the DOCC.

4.6.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-6 included advancement of two soil borings (SB-02-06-0601 and SB-02-06-0602) and the installation of two monitoring wells (MW-0618-S2 and MW-0619-S2) to evaluate groundwater quality in the vicinity of AOI 2-6. Monitoring well MW-0618-S2 was installed to replace monitoring well MW-2-S2. Monitoring well MW-2-S2 was destroyed during (or prior to) demolition activities. Phase II of the RFI included the advancement of seven soil borings (SB-02-06-0603 through SB-02-06-0609) to evaluate deep groundwater characteristics, characterize impacts observed in the vicinity of SB-02-06-0602 and define the downgradient extent of groundwater VOC impacts. In addition, four monitoring wells (MW-0643-S2, MW-0644-S2, MW-0645-S2 and MW-0647-S2) were installed to evaluate groundwater quality. During Phase III of the RFI, an additional five monitoring wells (MW-0701-S2, MW-0702-S2, MW-0704-S2, MW-0705 and MW-0706) were installed to further characterize groundwater VOC concentrations. The locations of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.6.2 Discussion of Results

4.6.2.1 Water Investigation

During Phase I of the RFI, soil boring SB-02-06-0601 and SB-02-06-0602 were advanced to investigate groundwater quality in the vicinity of AOI 2-6. Borehole water samples were collected from SB-02-06-0601 and SB-02-0602 at approximately 17 ft and 18 ft bgs, respectively. The borehole water samples were analyzed for VOCs. Analytical results from the borehole water samples collected indicate TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.6.1.

Groundwater samples were collected from monitoring wells MW-0618-S2 and MW-0619-S2 and analyzed for VOCs. Analytical results from the groundwater samples collected indicate vinyl chloride was detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1. Concentration contours of TCE, cis-1,2-DCE and vinyl chloride in groundwater at Plant 2 are presented in Drawings 4.1.3, 4.1.4 and 4.1.5, respectively.

During Phase II of the RFI, four borehole water samples were collected from approximately 20 ft bgs from soil borings SB-02-06-0603 and SB-02-06-0604, approximately 40 ft bgs from soil boring SB-02-06-0605 and approximately 30 ft bgs from soil boring SB-02-06-0606. With the exception of soil boring SB-02-06-0603, borehole water samples were analyzed for VOCs. Soil boring SB-02-06-0603 borehole water sample was analyzed for VOCs and BNs. Analytical results from the borehole water samples collected indicate benzene, cis-1,2-DCE, ethylbenzene, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.5 and Drawing 4.6.1.

Four monitoring wells (MW-0643-S2, MW-0644-S2, MW-0645-S2 and MW-0647-S2) were installed during Phase II of the RFI to characterize borehole water exceedances identified during Phase I of the RFI. Monitoring well MW-0646 was not installed as no saturated sand unit was observed in soil borings SB-02-06-0607 through SB-02-06-0609. Groundwater samples were collected from monitoring wells MW-0643-S2, MW-0644-S2, MW-0645-S2 and MW-0647-S2 and analyzed for VOCs. Analytical results from the groundwater samples collected indicate cis-1,2-DCE, TCE and vinyl chloride were detected at concentrations above drinking water criteria.

Between Phase II and Phase III of the RFI, monitoring well MW-0644 was resampled to confirm results from Phase II of the RFI. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected indicate methylene chloride was detected at a concentration above drinking water criteria. Methylene chloride is a common laboratory contaminant and is not considered a constituent that was released at the Facility. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1.

During Phase III of the RFI, six monitoring wells (MW-0701-S2 through MW-0706-S2) were installed to further characterize groundwater VOC concentrations. Analytical results from the groundwater samples collected indicate that vinyl chloride was detected at concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1.

4.6.3 Conclusion

Benzene, cis-1,2-DCE, ethylbenzene, TCE and vinyl chloride were detected above the drinking water criteria in AOI 2-6 during the RFI. Downgradient from AOI 2-6, groundwater is bounded by monitoring wells with concentrations below the drinking water criteria. Based on the data evaluation discussed above and on the cited tables

and drawings, the data collected adequately characterizes groundwater at and around AOI 2-6.

4.7 AOI 2-7 – Former Degreaser Area

The Former Degreaser Area was located in the southwest portion of the former Plant 2 building. AOI 2-7 was located indoors on concrete; however, the building has been demolished and the concrete slab has been removed. The area is currently covered with gravel. The location of AOI 2-7 is shown on Drawing 1.2.2. Additional information on AOI 2-7 is presented in Section 5.69 of the DOCC.

4.7.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-7 included the advancement of soil boring SB-02-07-0601 and the collection of a groundwater sample from monitoring well MW2-1-S2 to investigate soil and water, respectively, in the vicinity of AOI 2-7. The locations of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-02-07-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.7.2 Discussion of Results

4.7.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-07-0601 was advanced in AOI 2-7 to investigate soil in the vicinity of AOI 2-7. Two soil samples were collected from soil boring SB-02-07-0601 at 0 ft to 2 ft bgs and 8 ft to 10 ft bgs and analyzed for VOCs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.7.1.

4.7.2.2 Water Investigation

During Phase I of the RFI, monitoring well MW2-1-S2 was sampled to evaluate groundwater quality in the vicinity of AOI 2-7. A groundwater sample was collected and analyzed for VOCs. Analytical results from the groundwater sample collected indicate vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.7.1. Concentration contours of TCE, cis-1,2-DCE and vinyl chloride in groundwater at Plant 2 are presented in Drawings 4.1.3, 4.1.4 and 4.1.5, respectively.

4.7.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-7. Vinyl chloride was the only constituent detected above the drinking water criteria in the AOI. Downgradient from AOI 2-7, vinyl chloride is bounded by monitoring wells with concentrations below the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-7.

4.8 AOI 2-8 – Former Tin Plating Area

The Former Tin Plating Area was located in the central portion of the former Plant 2 building, due west of the Process Waste Sump (AOI 2-9). This area was the eastern most section of the Piston Skirts Manufacturing Area. AOI 2-8 was located indoors on concrete; however, the building has been demolished and the concrete slab has been removed. The area is currently covered with gravel. The location of AOI 2-8 is shown on Drawing 1.2.2. Additional information on AOI 2-8 is presented in Section 5.30 of the DOCC.

4.8.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-8 included the advancement of soil boring SB-02-08-0601 to evaluate soil quality in the vicinity of the former plating area. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-02-08-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.8.2 Discussion of Results

4.8.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-08-0601 was installed in AOI 2-8 to evaluate soil quality in the vicinity of the former plating area. Two soil samples were collected from soil boring SB-02-08-0601 at 0 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for metals. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.8.1.

4.8.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-8. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-8.

4.9 AOI 2-9 – Process Waste Sump

The Process Waste Sump was located near the southeast corner of the former Piston Skirts and Domes Manufacturing Area (AOI 2-8). AOI 2-9 was not identified by the USEPA during the PA/VSI. AOI 2-9 was located indoors on concrete; however, the building has been demolished and the concrete slab has been removed. The area is currently covered with gravel. The location of AOI 2-9 is shown on Drawing 1.2.2. Additional information on AOI 2-9 is presented in Section 5.30 of the DOCC.

4.9.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-9 included the advancement of soil boring SB-02-09-0601 to evaluate soil quality in the vicinity of the former process waste sump. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-02-09-0601 was completed in accordance with the RFI Work Plan (November, 2005). Groundwater evaluation was not necessary at this AOI because no pre-RFI data exceeded the drinking water criteria.

4.9.2 Discussion of Results

4.9.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-09-0601 was advanced to evaluate soil quality in the vicinity of the former process waste sump. Three soil samples were collected from soil boring SB-02-09-0601 at 0 ft to 2 ft, 8 ft to 10 ft and 16 ft to 18 ft bgs. All soil samples were analyzed for metals and PCBs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.7.1 and 4.8.1.

4.9.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-9. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-9.

4.10 AOI 2-10 – Former UST Area 5

The Former UST Area 5 was located in the southeast portion of Plant 2, due north of AOI 2-5, and directly south of the former Cooling Tower. AOI 2-10 was not identified by the USEPA during the PA/VSI. AOI 2-10 is located outdoors and is covered with gravel. The building in the vicinity of AOI 2-10 has been demolished and the concrete slab has been removed. The location of AOI 2-10 is shown on Drawing 1.2.2. Additional information on AOI 2-10 is presented in Section 5.30 of the DOCC.

4.10.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 2-10 included the advancement of soil boring SB-02-10-0601 to characterize potential PCB concentrations in the vicinity of AOI 2-10. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-02-10-0601 was completed in accordance with the RFI Work Plan (November, 2005). Groundwater evaluation was not necessary at this AOI because no pre-RFI data exceeded the groundwater criteria.

4.10.2 Discussion of Results

4.10.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-02-10-0601 was advanced to evaluate soil quality in the vicinity of AOI 2-10. Two soil samples were collected from soil boring SB-02-10-0601 at 0 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for PCBs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.7.1.

4.10.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 2-10. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2-10.

4.11 AOI 1 – Peninsula Area

The Peninsula Area (AOI 1) is located in the southwest portion of the Plant 3 property and was not identified by the USEPA during the 1993 PA/VSI. AOI 1 is located in a grassy area that includes a paved track that is used for vehicular transmission testing. The grassy area is mowed regularly. Trees are present on the north and south borders of the AOI and those areas are not mowed. The location of AOI 1 is shown on Drawing 1.2.2. Additional information on AOI 1 is presented in Section 5.1 of the DOCC. As discussed in Section 5.1 the DOCC, Big Eagle Creek was channelized and the former creek channel of Big Eagle Creek was filled during the rerouting of the creek. The historical channel was present within and adjacent to the boundaries of AOIs 1 and 2. In addition fill has been placed in the area to construct a mound for testing transmissions during uphill climbs. The risk-based screening of pre-RFI data for this AOI, as presented in the DOCC, showed that antimony, arsenic, barium, chromium, copper, iron, lead, manganese, silver, thallium and benzo(a)pyrene concentrations in soil exceeded the industrial or migration to groundwater soil criteria. Xylenes did not exceed the volatilization to indoor air soil screening criteria as identified in the DOCC; however, based on using industrial criteria instead of occupational criteria for developing the volatilization to indoor air screening criteria, xylenes exceed the criteria. The pre-RFI data also showed that iron, manganese and vanadium concentrations in groundwater exceeded the drinking water criteria.

4.11.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 1 involved the advancement of seven soil borings (SB-01-0601 through SB-01-0607) to characterize previous impacts (including fill and stained soil) identified in soil and groundwater at AOI 1. Phase II of the RFI included the installation of six soil borings (SB-01-0608 through SB-01-0613) and three monitoring wells (MW-0620-S1, MW-0621-S1 and SB-0649-S1). Phase III of the RFI included the installation of eight soil borings (SB-01-0701 through SB-01-0708) and one piezometer (PZ-01-0701). The location of the soil borings and monitoring wells in AOI 1 are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B.

Soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.11.2 Discussion of Results

4.11.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-01-0601 through SB-01-0608 were advanced in AOI 1 to investigate potential BN and metals impacts to soil from potential stained soil and fill. Two soil samples were collected from the 0 ft to 2 ft and 6 ft to 8 ft bgs sample intervals from soil borings SB-01-0601, SB-01-0603, SB-01-0605; SB-01-0606 and SB-01-0607. Three soil samples were collected from the 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs sample intervals from soil boring SB-01-0602. Two soil samples were collected from the.0 ft to 2 ft and 8 ft to 10 ft bgs sample intervals from soil boring SB-01-0604. The soil samples were analyzed for BNs and metals. Analytical results from the soil samples collected indicate that antimony, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, cadmium, chromium, copper, dibenz(a,h)anthracene, lead, manganese, mercury, silver and thallium were detected at concentrations above the industrial and/or migration to groundwater soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.11.1 and 4.11.2.

During Phase II of the RFI, six soil borings (SB-01-0608 through SB-01-0613) were advanced to characterize BN and metals concentrations identified during Phase I of the RFI. Soil samples were collected from the 0 ft to 2 ft and 8 ft to 10 ft bgs sample intervals from soil borings SB-01-0608 and SB-01-0609; and the 0 ft to 2 ft and 6 ft to 8 ft bgs sample intervals from soil borings SB-01-0610 through SB-01-0613. Soil samples were analyzed for BNs and metals. Analytical results from the soil samples collected indicate that antimony, arsenic, benzo(a)pyrene, cadmium, chromium, copper, lead, manganese, mercury and silver were detected at concentrations above the industrial and/or migration to groundwater soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.11.1 and 4.11.2.

During Phase III of the RFI, eight soil borings (SB-01-0701 through SB-01-0708) were advanced to characterize stained soil and fill, and BN and metals concentrations that were identified during Phase II of the RFI. Soil samples were collected from the 0 ft to 2 ft and 2 ft to 4 ft bgs sample intervals from soil boring SB-01-0706; the 0 ft to 2 ft and 6 ft to 8 ft bgs sample intervals from soil boring SB-01-0708; and the 0 ft to 2 ft and 4 ft to 6 ft bgs sample intervals from soil boring SB-01-0709. Soil samples were analyzed

for BNs and metals. Analytical results from the soil samples collected indicate that iron was detected at a concentration above the migration to groundwater soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.11.1 and 4.11.2.

Based on the soil borings advanced during the RFI, the horizontal and vertical extent of the stained soil and/or fill has been adequately characterized and is presented on Drawing 4.11.3.

4.11.2.2 Water Investigation

Borehole water samples were collected from soil borings SB-01-0601, SB-01-0602, SB-01-0604 and SB-01-0606 to characterize shallow groundwater quality. Borehole water samples were collected at approximately 15 ft bgs from SB-01-0601 and SB-01-0606 and at approximately 19 ft bgs from SB-01-0602 and SB-01-0604. The borehole water samples were analyzed for BNs and metals. Analytical results from the borehole water samples collected indicate that benzo(b)fluoranthene and fifteen metals were detected at concentrations above drinking water criteria. Note that the borehole water samples were not filtered prior to analysis and therefore the results could include contribution to the reported concentrations from solids in the sample. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.11.1 and 4.11.2.

During Phase II of the RFI, three monitoring wells MW-0620-S1, MW-0621-S1 and MW-0649-S1 were installed to determine if exceedances identified during Phase I of the RFI were due to solids in the borehole water samples. The groundwater samples were analyzed for BNs and metals. During groundwater sampling, turbidity of the groundwater samples were such that filtering of the sample was not warranted. Analytical results from the groundwater sample collected indicate lead and manganese at concentrations above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.11.1 and 4.11.2.

4.11.3 Conclusion

Several metals and BNs were detected at concentrations above the industrial soil criteria and/or the soil migration to groundwater criteria during the RFI; however, the concentrations decrease with distance from the center of the AOI and iron was the only constituent detected above the migration to groundwater soil criteria in the Phase III soil borings. Lead and manganese were the only constituents detected above the

drinking water criteria in groundwater in the AOI. The concentration of lead in the groundwater only slightly exceeded the drinking water criteria (ranging from 2.3 to 3.5 times). Due to the close proximity of the monitoring wells to Big Eagle Creek and its levee, it is not practical to install an additional downgradient monitoring well. Groundwater in the uppermost, saturated unit (S1) at AOI 1 discharges to Big Eagle Creek. Manganese concentrations in groundwater above the drinking water criteria were detected in an upgradient well and were not detected above the groundwater screening criteria in the downgradient monitoring wells. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 1.

4.12 AOI 2 – Baseball Diamond Area

The Baseball Diamond Area (AOI 2) is located in the northwest portion of the Plant 3 property and was not identified by the USEPA during the 1993 PA/VSI. A former gravel pit was located in the vicinity of the baseball diamonds. The historical limits of the former gravel pit over time is presented in Drawing 4.11.3. It has been recorded that materials such as construction debris, grinder dust, sludge from the skim basins, sludge from the waste treatment colloid air separator, potassium cyanide and possibly mineral spirits and oils may have been placed in the pit at some time in the past. AOI 2 is a grassy area that has been developed as recreational baseball fields. AOI 2 contains two baseball diamonds that are actively used for recreational purposes for UAW softball leagues. The grass is regularly mowed. AOI 2 also encompasses an area south of the baseball diamonds that includes the former creek channel that was filled during the rerouting of the creek (shown on Drawing 4.11.3). A considerable portion of the area south of the baseball diamonds is now paved and used for parking or driving vehicles to test transmissions. The location of AOI 2 is shown on Drawing 1.2.2. Additional information on AOI 2 is presented in Section 5.2 of the DOCC.

4.12.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 2 involved the advancement of sixteen soil borings (SB-02-0600 through SB-02-0615), installation of two monitoring wells (MW-0601-S2A and MW-0601-S3) and re-sampling of monitoring well MW-0408-S2 to investigate a former gravel pit, to characterize an identified black sandy material (appears to be foundry sand), in the shallow soils observed in this area of the Facility and to characterize soil and shallow groundwater quality in AOI 2. Phase II of the RFI included the installation of three soil borings (SB-01-0616 through SB-01-0618) and sampling of three monitoring wells (MW-0408-S2, MW-0601-S2A and MW-0601-S3).

Phase III of the RFI included the installation of twenty-four soil borings (SB-02-0701 through SB-02-0724) to further characterize an identified black sandy material in the soil and metals identified during Phase II of the RFI. The location of the soil borings and monitoring wells in AOI 2 are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.12.2 Discussion of Results

4.12.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-02-0601 and monitoring wells MW-0601-S2A and MW-0601-S3 were advanced in AOI 2 to investigate a former gravel pit, to characterize an identified black sandy material in the shallow soils observed in this area of the Facility and to characterize soil quality in AOI 2. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from soil boring MW-0601-S3. The soil samples were analyzed for VOCs, SVOCs, PCBs, metals and cyanide. Analytical results from the soil samples collected indicate that benzo(a)pyrene, copper and lead were detected at concentrations above the industrial soil criteria. Benzo(a)pyrene was detected in the 0 ft to 2 ft interval of one soil boring (MW-0601-S3), at 4.4 mg/kg, which exceeds the industrial screening criteria (2.1 mg/kg) by a factor of 2.1. Since the deeper soil sample collected at 8 ft to 10 ft bgs from the same boring was below the industrial screening criteria (2.3 mg/kg) and the surface sample was only slightly above the industrial screening criteria, no additional investigation was needed to characterize benzo(a)pyrene. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.12.1 and 4.12.2.

During Phase II of the RFI, three soil borings (SB-02-0616 through SB-02-0618) were advanced to characterize metals concentrations identified during Phase I of the RFI. Soil samples were collected from 0 ft to 2 ft, 6 ft to 8 ft and 14 ft to 16 ft bgs from soil borings SB-02-0616, SB-02-0617 and SB-02-0618. Soil samples were analyzed for metals. Analytical results from the soil samples collected indicate that cadmium, lead iron and silver were detected at concentrations above the industrial and/or migration to groundwater soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawing 4.12.2.

During Phase III of the RFI, twenty-four soil borings (SB-02-0701 through SB-02-0724) were advanced to further characterize an identified black sandy material in the soil and metals identified during Phase II of the RFI. Soil samples were collected from 0 ft to 2

ft bgs from soil boring SB-02-0708; 0 ft to 2 ft, 8 ft to 10 ft and 13 ft to 15 ft bgs from soil boring SB-02-0709; 0 ft to 2 ft and 4 ft to 6 ft bgs from soil boring SB-02-0712; 0 ft to 2 ft and 8 ft to 10 ft bgs from soil borings SB-02-0715, SB-02-0718, SB-02-0719 and SB-02-0720. Soil samples were analyzed for metals. The laboratory inadvertently analyzed the soil samples from these soil borings for iron. Iron is not identified as a constituent of concern for the Facility, and specifically is not a constituent of concern for this AOI. Analytical results from the soil samples collected indicate that iron was detected at concentrations above soil screening criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawing 4.12.2.

Based on the soil borings advanced during the RFI, the horizontal and vertical extent of the black sandy material has been adequately characterized and is presented on Drawing 4.11.3.

4.12.2.2 Water Investigation

During Phase I of the RFI, monitoring wells MW-0601-S2A and MW-0601-S3 were installed and groundwater samples were collected from monitoring wells MW-0408-S2, MW-0601-S2A and MW-0601-S3 to investigate shallow groundwater quality in AOI 2. The groundwater samples were analyzed for VOCs, SVOCs metals (total and/or dissolved) and cyanide. Analytical results from the groundwater samples indicate that arsenic and lead were detected at concentrations above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.12.1 and 4.12.2.

During Phase II of the RFI, groundwater samples were collected from monitoring wells MW-0408-S2, MW-0601-S2A and MW-0601-S3 to verify results from Phase I of the RFI. The groundwater samples were analyzed for VOCs, SVOCs and metals (total). Analytical results from the groundwater samples indicate that arsenic and benzo(a)anthracene were detected at concentrations above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.12.1 and 4.12.2.

During Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0601-S2A to verify results from Phase II of the RFI. The groundwater samples were analyzed for BNs and arsenic. Analytical results from the groundwater sample indicate that BNs and arsenic were not detected at concentrations above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.12.1 and 4.12.2.

4.12.3 Conclusion

During the RFI, benzo(a)pyrene was detected in soil from the 0 ft to 2 ft interval from boring MW-0601-S3, and slightly exceeded the industrial screening criteria (by a factor of 2.1). The deeper soil sample collected at 8 ft to 10 ft bgs from the same boring was below the screening criteria and the surface sample was only slightly above the industrial screening criteria. The laboratory inadvertently analyzed the soil samples from Phase III of the RFI for iron. Iron is not generally identified as a constituent of concern for the Facility, and specifically is not a constituent of concern for this AOI. Iron was detected above the soil migration to groundwater criteria. In 2004, a downgradient monitoring well MW-0408-S2 exhibited total iron concentrations above the drinking water criteria; however, the dissolved iron concentration in this well did not exceed any groundwater screening criteria. The focus of the soil characterization in AOI 2 was to determine the extent of the foundry sand that was used as fill, and select samples were analyzed for metals at the margins of the foundry sand. The extent of the foundry sand was characterized and is illustrated in Drawing 4.11.3 Soil samples collected at the margins of the foundry sand did not exceed soil screening criteria. Therefore it is reasonable to expect that benzo(a)pyrene in soil was also adequately characterized.

Arsenic, lead and benzo(a)anthracene were the only constituents detected above the drinking water criteria in the AOI from groundwater monitoring wells. However, lead and benzo(a)anthracene were not detected in the groundwater above groundwater screening criteria in the most recent sampling event for the respective monitoring wells. Due to the close proximity to Big Eagle Creek and its levee of the downgradient monitoring well in which arsenic was detected above drinking water criteria, it is not practical to install an additional downgradient monitoring well. Groundwater in the uppermost, saturated unit (S1) at AOI 2 discharges to Big Eagle Creek. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 2.

4.13 AOI 3 – Plant 7 Swarf Area

AOI 3 is located near the northwest corner of the Plant 7 building. This area consists of the Dock 35 Swarf and Shot Peening Storage Area. AOI 3 is located both inside Plant 7 and immediately outside. The inside portion has a concrete floor and the outside portion is paved and grass covered. The location of AOI 3 is shown on Drawing 1.2.2. Additional information on AOI 3 is presented in Section 5.3 of the DOCC.

4.13.1 Scope of Investigation

The scope of the RFI at AOI 3 involved the advancement of two soil borings (SB-03-0601 and SB-03-0602) to characterize soil and water quality in the areas where stained soil and asphalt in the area were identified during a site visit performed by ARCADIS on September 9, 2004. The locations of soil borings are illustrated on Drawing 1.2.2 and boring logs are provided in Appendix B. The soil borings SB-03-0601 and SB-03-0602 were installed in accordance with the RFI Work Plan (November, 2005).

4.13.2 Discussion of Results

4.13.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-03-0601 and SB-03-0602 were advanced in AOI 3 to investigate the presence of VOCs, BNs and metals in soil. Two soil samples were collected from the soil boring SB-03-0601 at 1 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs and BNs. Three soil samples were collected from the soil boring SB-03-0602 at 0 to 2 ft, 8 to 10 ft and 13 to 15 ft bgs and analyzed for VOCs, BNs, metals and PCBs. As shown in Table 4.1 and Drawings 4.13.1 and 4.13.2, no VOCs, BNs, metals or PCBs were detected at concentrations above soil screening criteria.

4.13.2.2 Water Investigation

One borehole water sample was collected at 19 ft below grade (bgs) from the soil boring advanced at SB-03-0602 to investigate water quality in the S1 unit. The borehole water was analyzed for VOCs, BNs and total metals. The borehole water sample was analyzed for PCBs during the investigation, even though sampling and analysis was not stated in the work plan. As presented in Table 4.5 and Drawings 4.13.1 and 4.13.2, no VOCs, BNs, metals or PCBs were detected at concentrations above groundwater screening criteria. Monitoring well MW-0408-S2 is located downgradient from AOI 3 and was analyzed for VOCs, SVOCs and metals. Results from monitoring well MW-0408-S2 are presented in Section 4.13.2.2. Arsenic was the only constituent detected above drinking water criteria in monitoring well MW-0408-S2.

4.13.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 3. Based on the data evaluation discussed above and on the cited

tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 3.

4.14 AOI 4 – Plant 7 West Trench

AOI 4 is located in the northwest corner of the Plant 7 building. This area consists of the Plant 7 West Trench. AOI 4 is located inside Plant 7 and has a concrete floor. The location of AOI 4 is shown on Drawing 1.2.2. Additional information on AOI 4 is presented in Section 5.4 of the DOCC.

4.14.1 Scope of Investigation

The scope of the RFI at AOI 4 involved the advancement of two soil borings, (SB-04-0601 and SB-04-0602) to characterize soil quality in the area where a below grade concrete trench (with a metal lining) was identified during a site visit performed by ARCADIS on September 9, 2004. The locations of soil borings are illustrated on Drawing 1.2.2 and boring logs are provided in Appendix B. Soil borings SB-04-0601 and SB-04-0602 were advanced in accordance with the RFI Work Plan (November, 2005).

4.14.2 Discussion of Results

4.14.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-04-0601 and SB-04-0602 were advanced in AOI 4 to investigate the presence of VOCs and BNs in soil. Two soil samples were collected from the soil boring SB-04-0601 at 1 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs and BNs. A sample was not collected from 18 to 20 ft bgs due to no recovery from the Geoprobe® sampler. Three soil samples were collected from the soil boring SB-04-0602 at 1 to 2 ft, 8 to 10 ft and 16 to 17 ft bgs and analyzed for VOCs and BNs. Additionally, soil samples were collected from 8 to 10 ft and 16 to 17 ft bgs due to the presence of an oily sheen in the soil sample from 16.5 to 17 ft bgs. These soil samples were analyzed for VOCs, BNs, PCBs and metals. As shown in Table 4.1 and Drawings 4.13.1 and 4.13.2, no VOCs, BNs, PCBs and metals were detected at concentrations above soil screening criteria.

4.14.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 4. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at AOI 4.

4.15 AOI 5 – Plant 7 East Trench

AOI 5 is located in the northwest corner of the Plant 7 building. This area is located indoors and has a concrete floor. The trench was used for the transport of metal chips and cuttings from machining areas in the plant to a common collection area. The concrete trench is below grade with a metal lining and contained a mechanical delivery system. The mechanical system associated with the trench has been removed from the trench and a portion of the trench has been filled with concrete. ARCADIS was unable to determine the integrity of the entirety of the trench due to the location of equipment in the area. The location of AOI 5 is shown on Drawing 1.2.2. Additional information on AOI 5 is presented in Section 5.5 of the DOCC.

4.15.1 Scope of Investigation

The scope of the RFI at AOI 5 involved the advancement of two soil borings, (SB-05-0601 and SB-05-0602) to characterize soil quality in the area where a below grade concrete trench (with a metal lining) was identified during a site visit performed by ARCADIS on September 9, 2004. The locations of soil borings are illustrated on Drawing 1.2.2 and boring logs are provided in Appendix B. The soil borings SB-05-0601 and SB-05-0602 were advanced in accordance with the RFI Work Plan (November, 2005).

4.15.2 Discussion of Results

4.15.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-05-0601 and SB-05-0602 were advanced in AOI 5 to investigate the presence of VOCs and BNs and metals in soil. Two soil samples were collected from the soil boring SB-05-0601 at 0 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs, BNs and metals. Two soil samples were collected from the soil boring SB-05-0602 at 1 to 2 ft, and 8 to 10 ft bgs and analyzed for VOCs, BNs and metals. As shown in Table 4.1 and Drawings 4.13.1 and

4.13.2, no VOCs, BNs or metals were detected at concentrations above soil screening criteria.

4.15.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 5. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 5.

4.16 AOI 6 – Dump Station and Hydromation

AOI 6 is located in the northern portion of Plant 7. This area consists of a dump station and the Hydromation system, which includes a large sub-grade concrete vault that handles oils and coolants. This area is located indoors and has a concrete floor. The location of AOI 6 is shown on Drawing 1.2.2. Additional information on AOI 6 is presented in Section 5.6 of the DOCC.

4.16.1 Scope of Investigation

The scope of the RFI at AOI 6 involved the advancement of one soil boring (SB-06-0601) and the installation of one monitoring well (MW-0603-S1). Soil and groundwater samples were collected to provide additional characterization data based on historical total petroleum hydrocarbon (TPH) concentrations in the area. The locations of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and boring logs are provided in Appendix B. Soil boring SB-06-0601 and monitoring well MW-0603-S1 were completed in accordance with the RFI Work Plan (November, 2005).

4.16.2 Discussion of Results

4.16.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-06-0601 was advanced and MW-0603-S1 was installed in AOI 6 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Two soil samples were collected from soil boring SB-06-0601 at 0 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs, BNs, PCBs and metals. Two soil samples were collected from MW-0603-S1 at 1 ft to 2 ft and 4 ft to 6 ft bgs and analyzed for VOCs, BNs, PCBs and metals. Analytical results from the soil samples indicate that thallium was detected at a concentration above migration to

groundwater soil criteria. Groundwater samples collected in downgradient monitoring well MW-0603-S1 does not contain concentrations of thallium exceeding groundwater screening criteria; therefore, no additional investigation is needed to delineate the thallium concentrations in soil exceeding migration to groundwater soil criteria. A summary of the soil samples are presented in Table 4.1 and Drawings 4.13.1 and 4.13.2

4.16.2.2 Water Investigation

During Phase I of the RFI, monitoring well MW-0603-S1 was installed and sampled to investigate water quality in the S1 unit in AOI 6. The groundwater was analyzed for VOCs, BNs, and metals (total). Analytical results from the groundwater sample indicate that arsenic was detected at a concentration above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.13.1 and 4.13.2.

A groundwater sample was proposed to be collected from monitoring well MW-0603-S1 during Phase II; however, the monitoring well was covered by equipment at the Plant and was not accessible.

During Phase III of the RFI, Allison Transmission was able to move the equipment in order to collect a groundwater sample from monitoring well MW-0603-S1. The groundwater sample was analyzed for arsenic (total and dissolved) to further characterize groundwater quality in the S1 unit. Arsenic (total and dissolved) was detected above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.13.2.

4.16.3 Conclusion

Thallium was detected in soil at a concentration above the soil migration to groundwater criteria within AOI 6. Groundwater samples collected in downgradient monitoring well MW-0603-S1 do not contain concentrations of thallium exceeding groundwater screening criteria; therefore, no additional investigation is needed to characterize the thallium concentrations in soil. Arsenic was the only constituent detected in groundwater above the drinking water criteria in the AOI. The concentration of arsenic in the groundwater only slightly exceeds the drinking water criteria (4.4 times). Downgradient from AOI 6, this well is bounded by monitoring wells with arsenic concentrations below the drinking water criteria. Based on the data

evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 6.

4.17 AOI 8 – Railroad Spur

AOI 8 is located in the northern portion of Plant 7 to the east of the Chip Hopper Area (AOI 7). The area consists of the railroad spur and is located indoors and has a concrete floor. The location of AOI 8 is shown on Drawing 1.2.2. Additional information on AOI 8 is presented in Section 5.8 of the DOCC.

4.17.1 Scope of Investigation

The scope of the RFI at AOI 8 involved the advancement of soil boring (SB-08-0601) and the installation of monitoring well (MW-0650-S1). Soil and groundwater samples were collected to provide additional characterization data based on historical TPH concentrations in the area. The location of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-08-0601 and monitoring well MW-0650-S1 were completed in accordance with the RFI Work Plan (November, 2005).

4.17.2 Discussion of Results

4.17.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-08-0601 was advanced in AOI 8 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Two soil samples were collected from the soil boring SB-08-0601 at 1 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs, BNs, PCBs and metals. As shown in Table 4.1 and Drawings 4.13.1 and 4.13.2, no VOCs, BNs, PCBs, or metals were detected at concentrations above soil screening criteria.

4.17.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from the soil boring advanced at SB-08-0601 to investigate water quality in the S1 unit. Borehole water was collected at 12 ft bgs from soil boring SB-08-0601. The borehole water was analyzed for VOCs, BNs and total metals. Twelve metals were detected at concentrations above drinking water criteria. A summary of laboratory sample results collected from groundwater sampling of soil boring SB-08-0601 is presented in Table 4.5 and Drawings 4.13.1 and 4.13.2.

Based on results from Phase I of the RFI, monitoring well MW-0650-S1 was installed during Phase II of RFI to determine if the metals exceedances in borehole water were due to turbidity issues (i.e., potential suspended solids) observed during previous sampling activities. The groundwater sample was analyzed for VOCs, BNs and metals. Arsenic was the only metal detected at a concentration above drinking water criteria. A summary of the groundwater sample is presented in Table 4.3 and Drawings 4.13.1 and 4.13.2.

During Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0650-S1 to confirm the water quality in the S1 unit. The groundwater was analyzed for arsenic (total and dissolved). Arsenic (total) was detected above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.13.2.

4.17.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 8. Arsenic was the only constituent detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 8, arsenic is bounded by monitoring wells with arsenic concentrations below the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 8.

4.18 AOI 9 – Waste Resin and Monlan System

AOI 9 is located in the southern portion of Plant 7. The area consists of a Waste Resin Area and includes a pit mounted degreaser and the Monlan System. AOI 9 is located indoors and has a concrete floor. The location of AOI 9 is shown on Drawing 1.2.2. Additional information on AOI 9 is presented in Section 5.9 of the DOCC.

4.18.1 Scope of Investigation

The scope of the RFI at AOI 9 involved the advancement of two soil borings (SB-09-0601 and SB-09-0602), the installation of monitoring well (MW-0651-S2) and the collection of a groundwater sample at existing monitoring well MW-23-S2 to characterize soil and water quality. The location of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings SB-09-0601, SB-09-0602 and monitoring well MW-0651-S2 were installed in accordance with the RFI Work Plan (November, 2005).

4.18.2 Discussion of Results

4.18.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-09-0601 and SB-09-0602 were advanced in AOI 9 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Three soil samples were collected from the soil boring SB-09-0601 at 1 to 2 ft, 8 to 10 ft and 12-14 ft bgs and analyzed for VOCs, BNs, PCBs and metals. Three soil samples were collected from the soil boring SB-09-0602 at 1 to 2 ft, 8 to 10 ft and 13-15 ft bgs and analyzed for VOCs, BNs, PCBs and metals. As shown in Table 4.1 and Drawings 4.13.1 and 4.13.2 no VOCs, BNs, PCBs, or metals were detected at concentrations above soil screening criteria.

4.18.2.2 Water Investigation

During Phase I of the RFI, borehole water samples were collected from soil borings SB-09-0601 and SB-09-0602 to further characterize water quality in the S1 unit. The borehole water was analyzed for VOCs, BNs and total metals. Borehole water samples were collected from SB-09-0601 and SB-09-0602 at 19 ft bgs. Eleven metals were detected at concentrations above drinking water criteria. A summary of the borehole water samples are presented in Table 4.5 and Drawings 4.13.1 and 4.13.2.

Based on the borehole water results, one monitoring well, MW-0651-S2, was installed during Phase II of RFI to determine if the metals exceedances were due to turbidity issues (i.e., potential suspended solids) observed during previous sampling activities. A groundwater sample was collected from monitoring well MW-0651-S2 and analyzed for VOCs and metals. Additionally, a groundwater sample from MW-23-S2 was collected and analyzed for chromium (total) and arsenic. Analytical results from the groundwater samples collected from MW-0651-S2 and MW-23-S2 indicate that no analytes were detected at concentrations above groundwater screening criteria. A summary of the groundwater sample is presented in Table 4.3 and Drawings 4.13.1 and 4.13.2.

During Phase III of the RFI, existing monitoring well MW-0651-S2 was sampled to characterize water quality in the S2 unit. The groundwater was analyzed for VOCs and BNs. Analytical results from the groundwater sample collected from MW-0651-S2 indicate that no analytes were detected at concentrations above groundwater screening criteria. A summary of the groundwater sample is presented in Table 4.3 and Drawing 4.13.1.

4.18.3 Conclusion

No constituents were detected in soil during the RFI above the soil screening criteria within AOI 9. Although the borehole water sample contained metals concentrations exceeding the groundwater screening criteria; the monitoring well that was subsequently installed to characterize the groundwater conditions did not contain constituents exceeding groundwater screening criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 9.

4.19 AOI 10 – Dexron System, Plant 7

AOI 10 is located in the southern portion of Plant 7 and consists of the Dexron System. AOI 10 is located indoors and has a concrete floor. The location of AOI 10 is shown on Drawing 1.2.2. Additional information on AOI 10 is presented in Section 5.10 of the DOCC.

4.19.1 Scope of Investigation

The scope of the RFI at AOI 10 involved the advancement of three soil borings (SB-10-0601, SB-10-0602 and SB-10-0603). Soil samples were collected to provide additional characterization data based on historical TPH concentrations in the area. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-10-0601, SB-10-0602 and SB-10-0603 were advanced in accordance with the RFI Work Plan (November, 2005).

4.19.2 Discussion of Results

4.19.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-10-0601, SB-10-0602, and SB-10-0603 were advanced in AOI 10 to investigate the presence of VOCs and BNs in soil. Three soil samples each were collected from soil borings SB-10-0601 and SB-10-0602 at 1 to 2 ft, 8 to 10 ft and 14 to16 ft bgs. Three soil samples were collected from the soil boring SB-10-0603 at 1 to 2 ft, 8 to 10 ft and 12 to 14 ft bgs. All soil samples were analyzed for VOCs and BNs. As shown in Table 4.1 and Drawing 4.13.1, VOCs and BNs, were not detected at concentrations above soil screening criteria.

4.19.2.2 Water Investigation

During the RFI, borehole water samples were collected from soil borings SB-10-0601and SB-10-0603 to investigate water quality in the S1 unit. Water was not encountered above the till unit in soil boring SB-10-0602; therefore, no borehole water sample was collected from this location. Borehole water samples were collected at 22 ft bgs from SB-10-0601 and 16 ft bgs from SB-10-0603. The borehole water samples were analyzed for VOCs and BNs. As shown in Table 4.5 and Drawings 4.13.1, no VOCs or BNs were detected at concentrations above groundwater screening criteria.

4.19.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 10. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 10.

4.20 AOI 11 – Former Flexible Machining System (FMS)

AOI 11 is located in the northwest portion of Plant 6. The area consists of the Flexible Machining System (FMS) and velocity trench. AOI 11 is located indoors and has a concrete floor. The location of AOI 11 is shown on Drawing 1.2.2. Additional information on AOI 11 is presented in Section 5.11 of the DOCC.

4.20.1 Scope of Investigation

The scope of the RFI at AOI 11 involved the advancement of two soil borings (SB-11-0601 and SB-11-0602) to characterize soil and water quality in the area where an abandoned concrete trench was identified during a site visit performed by ARCADIS on September 9, 2004.The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-11-0601 and SB-11-0602 were advanced in accordance with the RFI Work Plan (November, 2005).

4.20.2 Discussion of Results

4.20.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-11-0601 and SB-11-0602 were advanced in AOI 11 to investigate the presence of VOCs, BNs and metals in soil. Three soil samples were collected from soil boring SB-11-0601 at 1 ft to

2 ft, 8 ft to 10 ft and 14 ft to 16 ft bgs and analyzed for VOCs, BNs and metals. Two soil samples were collected from soil boring SB-11-0602 at 1 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for VOCs, BNs and metals. As shown in Table 4.1 and Drawings 4.13.1 and 4.13.2 VOCs, BNs or metals were not detected at concentrations above soil screening criteria.

4.20.2.2 Water Investigation

Borehole water samples were to be collected to characterize the groundwater quality in the area; however, neither borehole produced water sufficient to collect a borehole water sample for analysis. Therefore, no water samples were collected from AOI 11.

4.20.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 11. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at and around AOI 11.

4.21 AOI 12 – Dexron System – Plant 6

AOI 12 is located in the eastern portion of Plant 6. The area consists of the Dexron System that was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 12 is located indoors and has a concrete floor. The location of AOI 12 is shown on Drawing 1.2.2. Additional information on AOI 12 is presented in Section 5.12 of the DOCC.

4.21.1 Scope of Investigation

The scope of the proposed RFI at AOI 12 involved the advancement of three soil borings (SB-12-0601 through SB-12-0603) to characterize soil and groundwater quality in the vicinity of an abandoned series of below grade pits and sumps that are an integral part of the Dexron System. These pits and sumps were identified during a site visit performed by ARCADIS on September 9, 2004. During field screening activities associated with locating of the proposed soil borings, it was identified that only two soil borings could be installed due to the congestion of machines and utilities in the area. The location of the soil borings that were installed is illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-12-0601 and SB-12-0602 were completed in accordance with the RFI Work Plan (November, 2005).

4.21.2 Discussion of Results

4.21.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-12-0601 and SB-12-0602 were advanced in AOI 12 to investigate the presence of VOCs and BNs in soil. Three soil samples were collected from soil boring SB-12-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs and analyzed for VOCs and BNs. Three soil samples were collected from soil boring SB-12-0602 at 1 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs and analyzed for VOCs and BNs. As shown in Table 4.1 and Drawing 4.21.1, VOCs or BNs were not detected at concentrations above soil screening criteria.

4.21.2.2 Water Investigation

During Phase I of the RFI, borehole water samples were collected from soil borings SB-12-0601 and SB-12-0602 to investigate water quality in the first encountered saturated sand unit underlying the AOI. Borehole water samples were collected at 19 ft from SB-12-0601 and at 16 ft from SB-12-0602. The borehole water samples were analyzed for VOCs and BNs. As shown in Table 4.5 and Drawing 4.21.1, VOCs or BNs were not detected at concentrations above groundwater screening criteria.

4.21.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 12. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 12.

4.22 AOI 13 – Plating, Degreasing and Derust Area

AOI 13 is located in the eastern portion of Plant 6. This area consists of two former floor mounted degreasers, two former degreasers (located in the basement), a derusting area and a mop station. These operational units were identified during a site visit performed by ARCADIS on September 9, 2004. AOI 13 is located indoors and has a concrete floor. This AOI is near several test cells. The location of AOI 13 is shown on Drawing 1.2.2. Additional information on AOI 13 is presented in Section 5.13 of the DOCC.

4.22.1 Scope of Investigation

The scope of the RFI at AOI 13 involved the advancement of four soil borings (SB-13-0601 through SB-13-0604) during Phase I and the installation of one monitoring well (MW-0652-S1) during Phase II. These borings were completed to characterize soil and groundwater quality. One of the locations (SB-13-0604) was not accessible for installation due to flooding in the basement. The location of the soil borings and monitoring well are illustrated on Drawing 1.2.2. The boring logs generated during installation are provided in Appendix B. Soil borings SB-13-0601, SB-13-0602 and SB-13-0603, and monitoring well MW-0652-S1 were completed in accordance with the RFI Work Plan (November, 2005).

4.22.2 Discussion of Results

4.22.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-13-0601 and SB-13-0603 were advanced in AOI 13 to investigate the presence of VOCs, BNs, metals and cyanide (total) in soil. Soil boring SB-13-0602 was advanced in AOI 13 to investigate the presence of VOCs, BNs, PCBs, metals and cyanide (total) in soil. Three soil samples were collected from soil boring SB-13-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs and analyzed for VOCs, BNs, metals and cyanide (total). Two soil samples were collected from soil boring SB-13-0602 at 1 ft to 2 ft and 4 ft to 6 ft bgs and analyzed for VOCs, BNs, PCBs (only 4 ft to 6 ft bgs sample interval), metals and cyanide (total). Two soil samples were collected from soil boring SB-13-0603 at 1 ft to 2 ft and 2 ft to 3 ft bgs and analyzed for VOCs, BNs, metals and cyanide (total). Soil boring refusal was encountered at 3 ft bgs during the installation on soil boring SB-13-0603. Soil samples were therefore not collected deeper than 3 ft bgs. Analytical results from the soil sample collected from 1 ft to 2 ft at SB-13-0602 indicate that benzo(a)pyrene was detected at concentrations above the industrial soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.21.1 and 4.22.1.

4.22.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected from the soil boring advanced at SB-13-0601 to investigate water quality in the S1 unit. Borehole water was collected at approximately 17 ft bgs from within SB-13-0601. The borehole water was analyzed for VOCs, BNs, total metals and cyanide (total). Nine metals were

detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.21.1 and 4.22.1.

Based on results from Phase I of the RFI, a monitoring well, MW-0652-S1 was installed during Phase II of the RFI to determine if the metals exceedances were due to turbidity issues (i.e. potential suspended solids) observed during previous sampling activities. The groundwater was analyzed for VOCs, BNs and metals (total and dissolved). Analytical results from the groundwater sample indicate that PCE was detected at a concentration above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.21.1 and 4.22.1.

During Phase III of the RFI, monitoring well MW-0652-S1 was re-sampled to confirm the water quality in the S1 unit. The groundwater was analyzed for VOCs and metals (total and dissolved). Analytical results from the groundwater sample indicate that manganese was detected at a concentration above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.21.1 and 4.22.1.

4.22.3 Conclusion

Benzo(a)pyrene was the only constituent detected in soil above the industrial soil criteria within AOI 13. Benzo(a)pyrene was detected above the industrial soil criteria in one soil sample in one soil boring out of three soil borings in the AOI and the detected concentration only slightly exceeded the industrial soil criteria (2.6 times). Although the borehole water sample contained metals concentrations exceeding the groundwater screening criteria; the monitoring well installed to characterize the groundwater contained only manganese (total) at concentrations exceeding groundwater screening criteria during the most recent sampling event. Dissolved manganese did not exceed the groundwater screening criteria for the sample collected on the same date. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 13.

4.23 AOI 14 – West Spill Containment Sump

AOI 14 is located in a courtyard between Plant 6 and Plant 3. The area consists of the West Spill Containment Sump that was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 14 is located outdoors in an area paved with

concrete. The location of AOI 14 is shown on Drawing 1.2.2. Additional information on AOI 14 is presented in Section 5.14 of the DOCC.

4.23.1 Scope of Investigation

The scope of the RFI at AOI 14 involved the advancement of two soil borings (SB-14-0601 and SB-14-0602) to characterize soil and water quality. In addition, a groundwater sample was collected down-gradient from AOI 14 from the existing monitoring well MW-20-S1. The location of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-14-0601 and SB-14-0602 were advanced in accordance with the RFI Work Plan (November, 2005).

4.23.2 Discussion of Results

4.23.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-14-0601 and SB-14-0602 were advanced in AOI 14 to investigate the presence of VOCs, PCBs and cyanide (total) in soil. Three soil samples were collected from soil boring SB-14-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs and analyzed for VOCs, PCBs and cyanide (total). Two soil samples were collected from soil boring SB-14-0602 at 1 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for VOCs, PCBs and cyanide (total). As shown in Table 4.1 and Drawings 4.21.1 and 4.22.1, VOCs, PCBs or cyanide (total) were not detected at concentrations above soil screening criteria.

One soil sample was collected from soil boring SB-FL-0611 at 0 ft to 2.5 ft bgs during an investigation to characterize soil prior to installation of an upgraded fireline system. The sample was analyzed for VOCs, SVOCs and PCBs. Benzo(a)pyrene was detected at a concentration above the industrial soil criteria. The soil was excavated during the installation of the fireline. A summary of soil analytical results is presented in Table 4.1 and Drawing 4.21.1.

4.23.2.2 Water Investigation

During Phase I of the RFI, two borehole water samples were collected from the soil borings advanced at SB-14-0601 and SB-14-0602 to investigate water quality in the S1 unit. Borehole water samples were collected at approximately 18 ft bgs from SB-14-0601 and at 14 ft bgs from SB-14-0602. The borehole water samples were analyzed

for VOCs. As shown in Table 4.5 and Drawing 4.21.1 and 4.22.1, VOCs were not detected at concentrations above groundwater screening criteria.

During the RFI, existing monitoring well MW-20-S1 was sampled to investigate groundwater quality in the S1 unit downgradient of AOI 14. The groundwater sample collected was analyzed for VOCs. Analytical results from the groundwater sample indicate that vinyl chloride was detected at a concentration above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawing 4.21.1.

4.23.3 Conclusion

Benzo(a)pyrene was detected in soil during the RFI above the industrial soil criteria within AOI 14; however, this location was excavated by Allison during the installation of a fireline utility at the Facility. Vinyl chloride was the only constituent detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 14, vinyl chloride is bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 14.

4.24 AOI 15 – Former Gasoline UST and Remediation System

AOI 15 is located southwest of Plant 3. The area consists of a former 10,000-gallon gasoline UST and a former remediation system (pump-and-treat and SVE). The UST was removed in 1992 in response to a release reported to IDEM. A remediation system was installed in 1992 to address soil and groundwater impacts. The remediation system was removed in 2002 after receiving a No-Further Action letter from IDEM. AOI 15 is located outdoors and is paved with concrete. The location of AOI 15 is shown on Drawing 1.2.2. Additional information on AOI 15 is presented in Section 5.15 of the DOCC.

4.24.1 Scope of Investigation

The scope of the RFI at AOI 15 involved the collection of a groundwater sample from existing monitoring well MW-3-2-S1 to characterize current groundwater conditions. Soil sampling was not conducted since AOI 15 received a No-Further Action letter from IDEM. The location of the monitoring well is illustrated on Drawing 1.2.2. Monitoring

well MW-3-2-S1 was sampled in accordance with the RFI Work Plan (November, 2005).

4.24.2 Discussion of Results

4.24.2.1 Water Investigation

During Phase I of the RFI, one groundwater sample was collected from existing monitoring well MW-3-2-S1. The groundwater sample was analyzed for VOCs. As shown in Table 4.3 and Drawing 4.21.1, VOCs were not detected at concentrations above groundwater screening criteria.

4.24.3 Conclusion

IDEM granted Allison a No Further Action letter for the UST in AOI 15 on June 21, 2001; therefore, no soil investigation was conducted in association with the RFI. No constituents in groundwater were detected during the RFI above the groundwater screening criteria within AOI 15. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 15.

4.25 AOI 16 – Plant 3 Test Cells Spill Containment Sump

AOI 16 is located southwest of Plant 3. The area consists of the Test Cells Spill Containment Sump, a 2,000-gallon capacity below-grade secondary containment catch basin (used to receive process wastewater). The area was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 16 is located outdoors and is paved with concrete. The location of AOI 16 is shown on Drawing 1.2.2. Additional information on AOI 16 is presented in Section 5.16 of the DOCC.

4.25.1 Scope of Investigation

The scope of the RFI at AOI 16 involved the advancement of one soil boring (SB-16-0626-S1) during Phase I and the installation of one monitoring well (MW-0626-S1) during Phase II to characterize soil and groundwater quality due to the potential for release of hazardous constituents associated with the containment sump. The location of the soil boring and monitoring well are illustrated on Drawing 1.2.2. Soil boring logs are provided in Appendix B. Soil boring SB-016-0601 and monitoring well MW-0626-S1 were completed in accordance with the RFI Work Plan (November, 2005).

4.25.2 Discussion of Results

4.25.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-16-0601 was advanced in AOI 16 to investigate the presence of VOCs, BNs, PCBs, metals and cyanide (total) in soil. Three soil samples were collected from soil boring SB-16-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs and analyzed for VOCs, BNs, PCBs, metals and cyanide (total). Analytical results from the groundwater sample collected indicate that no constituents of concern were detected at concentrations above groundwater screening criteria. A summary of soil analytical results is presented in Table 4.1 and Drawing 4.22.1 and 4.25.

4.25.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected from the soil boring advanced at SB-16-0601 to characterize water quality in the S1 unit. Borehole water was collected at approximately 16 ft bgs from SB-16-0601. The borehole water was analyzed for VOCs, BNs, total metals and cyanide (total). Analytical results from the groundwater sample collected indicate eight metals were detected at concentrations above drinking water criteria. A summary of borehole water analytical results is presented in Table 4.5 and Drawing 4.22.1 and 4.25.1.

Based on results from Phase I of the RFI, monitoring well MW-0626-S1 was installed during Phase II of the RFI to determine if the metals exceedances were due to turbidity issues (i.e., potential suspended solids) observed during previous sampling activities. The groundwater was analyzed for metals (total and dissolved). Analytical results from the groundwater sample collected indicate that no constituents of concern were detected at concentrations above groundwater screening criteria. A summary of groundwater analytical results is presented in Table 4.3 and Drawing 4.22.1.

During Phase III of the RFI, monitoring well MW-0626-S1 was re-sampled to confirm the water quality in the S1 unit. The groundwater was analyzed for metals (total and dissolved). Analytical results from the groundwater sample collected indicate that no constituents of concern were detected at concentrations above groundwater screening criteria. A summary of groundwater analytical results is presented in Table 4.3 and Drawing 4.22.1.

4.25.3 Conclusion

No constituents were detected in soil during the RFI above the soil screening criteria within AOI 16. Although the borehole water sample contained metals concentrations exceeding the groundwater screening criteria; the monitoring well installed to characterize the groundwater conditions did not contain constituents exceeding groundwater screening criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 16.

4.26 AOI 17 – Test Cell 24 Basement

AOI 17 is located in the eastern portion of Plant 3. The Test Cell 24 Basement consisted of a chromic acid storage tank (SWMU 3) and a plating liquid waste storage tank (SWMU 4) identified by the USEPA during the PA/VSI. In addition, AOI 17 contained a plating area (cyanide/chrome/electroless nickel) and two floor mounted degreasers. The plating area and degreasers were identified during a site visit performed by ARCADIS on September 9, 2004; however, in the summer of 2007, Allison decommissioned the plating area. The degreasers, plating baths, storage tanks and ductwork were decontaminated and removed from the main floor, basement and penthouse for off-Site disposal by Allison. AOI 17 is located indoors and has a concrete floor; however, a courtyard is located just outside the AOI. The location of AOI 17 is shown on Drawing 1.2.2. Additional information on AOI 17 is presented in Section 5.17 of the DOCC.

4.26.1 Scope of Investigation

The scope of the RFI at AOI 17 involved the advancement of two hand auger soil borings (SB-17-0601 and SB-17-0602) and one soil boring south of the basement to characterize soil quality. One of the proposed soil borings in the basement and the proposed soil boring that was to be installed south of the basement were unable to be advanced due to utilities (above- and below-grade) in the area.

During Phase II, one soil boring (SB-17-0602) was proposed and installed in the courtyard to the west of the test cell to investigate potential surface soil impacts from exhaust from the test cells. In addition, one monitoring well was proposed south of the test cell. Due to issues associated with operating a drill rig with inadequate overhead clearance, the proposed monitoring well was not installed.

The location of the soil borings installed during the RFI are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings were completed in accordance with the RFI Work Plan (November, 2005).

4.26.2 Discussion of Results

4.26.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), hand auger soil boring SB-17-0601 was advanced in AOI 17 to investigate the presence of VOCs, BNs, metals and cyanide (total) in soil beneath the basement. Two soil samples were collected from hand auger soil boring SB-17-0601 at 1 to 2 ft and 2 to 4 ft bgs and analyzed for VOCs, BNs, metals and cyanide (total). Analytical results from the soil samples collected as part of this investigation indicate that chromium (total) and arsenic (detected in field duplicate) were detected at concentrations above migration to groundwater soil criteria. Due to subsurface utilities, subsurface structures and access limitations, one soil boring in the basement and one soil boring south of the basement were unable to be installed. The concentration of chromium (total) from 2 ft to 4 ft below the basement floor (59.5 mg/kg) is only slightly above the migration to groundwater soil criteria (1.2 times). A sample from the nearest downgradient monitoring well, MW-0626-S1, was analyzed for chromium and did not exhibit chromium concentrations above the laboratory reporting limits. Therefore, further characterization of the soil is not necessary. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.22.1 and 4.25.1.

During Phase II of the RFI investigation, two soil samples were collected from hand auger soil boring SB-17-0602, located in the courtyard, at 0 ft to 2 ft and 2 ft to 4 ft bgs and analyzed for lead, chromium (total), and hexavalent chromium. No constituents were detected at concentrations above soil screening criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawing 4.22.1.

4.26.3 Conclusion

Arsenic and chromium (total) were detected in soil above the soil screening criteria within AOI 17 during the RFI. The concentration of chromium (total) from 2 ft to 4 ft below the basement floor is only slightly above the migration to groundwater soil criteria (1.2 times). In addition, the nearest downgradient monitoring well MW-0626-S1 was analyzed for chromium and did not exhibit concentrations above the laboratory

reporting limits. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at AOI 17.

4.27 AOI 19 – Waste Treatment

AOI 19 is located both indoors and outdoors. Areas within the Waste Treatment Building are located indoors and have concrete floors. The areas outside the building are paved with concrete or asphalt. The location of AOI 19 is shown on Drawing 1.2.2. AOI 19 is located in a courtyard in the west-central portion of Plant 3. Waste Treatment consists of 12 SWMUs identified by the USEPA in the PA/VSI. PCBs are stored on the second floor, in a locked area identified as a PCB Storage Area. In addition, the AOI includes the Test Cell Lift Station/Sump, Waste Treatment Area, Contaminated Soils and Cyanide/Chromic Acid ASTs. These areas were identified during a site visit performed by ARCADIS on September 9, 2004. Additional information on AOI 19 is presented in Section 5.19 of the DOCC.

4.27.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 19 involved the installation of four monitoring wells (MW-0505-S1, MW-0506-S1, MW-0507-S1 and MW-0508-S1) and the collection of groundwater samples at monitoring wells MW-11-S1 and MW-0204-S2 to characterize soil and water quality. Monitoring well MW-11-S1 was installed in 1992 and monitoring well MW-0204-S2 was installed in 2002. Since there are multiple years of data for these monitoring wells, only the most recent round of data for each chemical from each well are used for the risk assessment. During the installation of MW-0505, an underground utility was encountered. The underground utility was repaired and the location abandoned. The location was renamed SB-19-0601. A replacement monitoring well (MW-0605-S2) was installed north of the originally proposed location. Prior to Phase I of the RFI, a NAPL was identified in monitoring well MW-0413-S1 and a sample was collected during the RFI and analyzed for VOCs, BNs and PCBs. During Phase II of the RFI, a monitoring well (MW-0648) was proposed between the former USTs and the skim basin, if accessible; however, a location clear of utilities was unable to be found. Prior to Phase III of the RFI, monitoring well MW-11-S1 was redeveloped by surging the screen and pumping water from the well. Approximately 90-gallons of water were purged during redevelopment. During Phase III of the RFI, groundwater samples were collected from monitoring wells MW-11-S1, MW-0506-S1, MW-0507-S1 and MW-0508-S1 to confirm the water quality in the S1 unit. The location of the soil boring and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-19-0601 and monitoring wells

MW-0506-S1, MW-0507-S1, MW-0508-S1 and MW-0605-S2 were completed in accordance with the RFI Work Plan (November, 2005).

4.27.2 Discussion of Results

4.27.2.1 Soil Investigation

Due to access concerns, monitoring wells MW-0506-S1, MW-0507-S1, MW-0508-S1 and MW-0605 were installed prior to the start of the RFI. Soil samples were collected to investigate the presence of VOCs, BNs and metals in soil. Two soil samples were collected from soil boring MW-0506-S1 at 0 ft to 2 ft and 8 ft to 10 ft bgs; two soil samples were collected from soil boring MW-0507-S1 at 0 ft to 2 ft and 8 to 10 ft bgs; and three soil samples were collected from soil boring MW-0508-S1 at 0 ft to 2 ft, 8 to 10 ft and 14 ft to 16 ft bgs. All soil samples were analyzed for VOCs, BNs and metals. Analytical results from the soil samples collected indicate that antimony, chromium (total) and iron were detected at concentrations above the migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.25.1 and 4.27.1.

4.27.2.2 Water Investigation

Due to area access concerns (Allison was installing a cooling tower on the roof in the Waste Treatment Area and would not allow for installation of monitoring wells during construction of the cooling tower), monitoring wells MW-0506-S1, MW-0507-S1, MW-0508-S1 were installed prior to Phase I of the RFI. Monitoring well MW-0508-S1 was attempted; however, a utility was encountered during the installation and the monitoring well was abandoned. The groundwater samples were collected and analyzed for VOCs, BNs and metals. Analytical results from the groundwater samples indicate that arsenic and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.25.1 and 4.27.1. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively.

During Phase I of the RFI, monitoring well MW-0605-S2 was installed north of the attempted MW-0505-S1 location. Groundwater samples were collected from monitoring wells MW-11-S1, MW-0204-S2, MW-0506-S1, MW-0507-S1, MW-0508-S1 and MW-0605-S2 to investigate water quality in the S1 and S2 units. The groundwater samples were analyzed for VOCs, BNs and metals. In addition, groundwater samples

collected from MW-11-S1, MW-0204-S2 and MW-0508-S1 were analyzed for dissolved metals due to elevated turbidity of the groundwater as observed during sampling activities. Analytical results from the groundwater samples indicate that chromium (total and dissolved) and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the groundwater samples are presented in Table 4.3 and Drawings 4.25.1 and 4.27.1.

During Phase II of the RFI, groundwater samples were collected from monitoring wells MW-11-S1, MW-0204-S2 and MW-0507-S1 to verify results identified in Phase I of the RFI. The groundwater sample collected from MW-11-S1 was analyzed for chromium (total) and hexavalent chromium (chromium VI). The groundwater sample collected from MW-0204-S2 was analyzed for VOCs. The groundwater sample collected from MW-0507-S1 was analyzed for cadmium (total). Analytical results from the groundwater samples indicate that trivalent chromium (chromium III (total) was detected at concentrations above drinking water criteria. A summary of the groundwater sample is presented in Table 4.3 and Drawing 4.27.1.

During Phase III of the RFI, groundwater samples were collected from monitoring wells MW-11-S1, MW-0506-S1, MW-0507-S1 and MW-0508-S1 to confirm the water quality in the S1 unit. The groundwater sample collected from MW-11-S1 was analyzed for chromium (total) and chromium VI. Groundwater samples collected from MW-0506-S1, MW-0507-S1 and MW-0508-S1 were analyzed for PCBs, as requested by USEPA. Chromium (trivalent) was detected at a concentration above drinking water criteria in the field duplicate for MW-11-S1; however, chromium (trivalent) did not exceed drinking water criteria in MW-11-S1. A summary of the groundwater sample is presented in Table 4.3 and Drawings 4.25.1 and 4.27.1.

4.27.2.3 NAPL Investigation

A sample of the non-aqueous phase liquid (NAPL) identified in MW-0413-S2 was collected and analyzed for VOCs, BNs and PCBs. Several compounds (ethylbenzene, xylenes, TCE, bis(2-ethylhexyl)phthalate) were detected in the NAPL sample in addition to PCBs (14 mg/kg). A confirmation sample was collected and analyzed for PCBs. PCBs were detected in the NAPL sample at a concentration of 31 mg/kg. In addition, a sample of the NAPL was analyzed for a “fingerprint analysis” (C3 through C44). Zymax Laboratories identified the sample as a heavy petroleum product, such as a lubricating oil or mineral oil. The historical gauging of NAPL (thickness) identified in monitoring well MW-0413-S2 is presented in Drawing 4.27.3. Analytical results for the NAPL sample are summarized in Table 4.6.

4.27.3 Conclusion

Antimony, chromium (total) and iron were detected in soil at concentrations above the soil migration to groundwater criteria during the RFI. Antimony and iron were not detected in groundwater from monitoring wells at AOI 19. Chromium (trivalent) was detected at a concentration above drinking water criteria in the field duplicate for MW-11-S1; however, chromium (trivalent) did not exceed drinking water criteria in the parent sample from this well. Therefore, the soil is adequately characterized at AOI 19. Arsenic, chromium (total and trivalent) and vinyl chloride were the only constituents detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 19, the saturated zone within S1 pinches out. Downgradient from where the saturated zone within S1 pinches out, there are monitoring wells in S2 that do not have concentrations higher than the drinking water criteria. NAPL observed in monitoring well MW-0413-S1 contains PCBs. Groundwater from the monitoring wells in the vicinity of MW-0413-S1 were analyzed for PCBs and did not contain detections above the laboratory reporting limits. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 19.

4.28 AOI 22 – Paint Booth Sump

AOI 22 is located in the north-central portion of Plant 3. The paint booth sump was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 22 is located indoors and has a concrete floor. The location of AOI 22 is shown on Drawing 1.2.2. Additional information on AOI 22 is presented in Section 5.22 of the DOCC.

4.28.1 Scope of Investigation

The scope of the RFI at AOI 22 involved the advancement of one soil boring (SB-22-0601) to characterize soil quality. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-22-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.28.2 Discussion of Results

4.28.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-22-0601 was advanced in AOI 22 to investigate the presence of VOCs and metals in soil. Two soil

samples were collected from soil boring SB-22-0601 at 1 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs and metals. As shown in Table 4.1 and Drawings 4.25.1 and 4.27.1, VOCs or metals were not detected at concentrations above soil screening criteria.

4.28.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 22. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at and around AOI 22.

4.29 AOI 23 – Dexron System – Plant 3

AOI 23 is located in the north-central portion of Plant 3. The area consists of the Dexron System, which was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 23 is located indoors and has a concrete floor. The location of AOI 23 is shown on Drawing 1.2.2. Additional information on AOI 23 is presented in Section 5.23 of the DOCC.

4.29.1 Scope of Investigation

The scope of the RFI at AOI 23 involved the advancement of two soil borings (SB-23-0601 and SB-23-0602) to characterize soil and water quality. One of the locations (SB-23-0601) could not be installed due to congestion of machines and utilities in the area. The location of the soil boring that was installed is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-23-0602 was advanced in accordance with the RFI Work Plan (November, 2005).

4.29.2 Discussion of Results

4.29.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-23-0602 was advanced in AOI 23 to investigate the presence of VOCs and BNs in soil. Three soil samples were collected from soil boring SB-23-0602 at 1 to 2 ft, 8 ft to 10 ft and 12 to 14 bgs and analyzed for VOCs and BNs. As shown in Table 4.1 and Drawing 4.25.1, VOCs or BNs were not detected at concentrations above soil screening criteria. Although soil boring SB-23-0601 was unable to be installed due to access restrictions (equipment and utilities) in the area, all analytical results from SB-23-0602 were not

detected above the soil screening criteria; therefore, no additional soil investigation is warranted.

4.29.2.2 Water Investigation

During the RFI, one borehole water sample was collected from the soil boring advanced at SB-23-0602 to investigate water quality in the S1 unit. A borehole water sample was collected at 18 ft bgs from SB-23-0602 and analyzed for VOCs and BNs. Analytical results from the borehole water sample indicate that bis(2-ethylhexyl)phthalate was detected at a concentration above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.25.1 and 4.25.2.

4.29.3 Conclusion

No constituents were detected in soil during the RFI above the soil screening criteria within AOI 23. Although soil boring SB-23-0601 was unable to be installed due to access restrictions (equipment and utilities) in the area, all analytical results from SB-23-0602 were not detected above the soil screening criteria. In addition, results from boring SB-22-0601 also characterize AOI 23 and no constituents were detected above soil screening criteria. Soil boring SB-23-0602 was installed as close to AOI 23 as possible. Therefore, no additional soil investigation is warranted. Bis(2-ethylhexyl)phthalate was the only constituent detected in borehole water above the drinking water criteria in the AOI. Bis(2-ethylhexyl)phthalate is not considered a constituent of concern but it is bounded by downgradient monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 23.

4.30 AOI 24 – Metal Chip Silos

AOI 24 is located outside the northeast portion of Plant 3. AOI 24 consists of the metal chip silos that were identified as SWMU 32 by the USEPA in the PA/VSI. During the site visit performed by ARCADIS on September 9, 2004, a chip loading area and stained soil area were identified. AOI 24 is located outdoors and is paved with concrete. The location of AOI 24 is shown on Drawing 1.2.2. Additional information on AOI 24 is presented in Section 5.24 of the DOCC.

4.30.1 Scope of Investigation

The scope of the RFI at AOI 24 involved the advancement of two soil borings (SB-24-0601 and SB-24-0602) to characterize soil and water quality. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-24-0601 and SB-24-0602 were completed in accordance with the RFI Work Plan (November, 2005). No groundwater samples were collected because pre-RFI data did not suggest a potential release to groundwater at monitoring well MW-9-S1.

4.30.2 Discussion of Results

4.30.2.1 Soil Investigation

As proposed in RFI Work Plan (November, 2005), soil borings SB-24-0601 and SB-24-0601 were advanced in AOI 24 to investigate the presence of VOCs, BNs and PCBs in soil. Two soil samples were collected from soil boring SB-24-0601 at 1.5 ft to 2 ft and 8 ft to 10 ft bgs and two soil samples were collected from soil boring SB-24-0602 at 1.5 ft to 2 ft and 6 ft to 8 ft bgs. The soil samples were analyzed for VOCs, BNs and PCBs. As shown in Table 4.1 and Drawing 4.30.1, VOCs, BNs or PCBs were not detected at concentrations above soil screening criteria.

4.30.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 24. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at and around AOI 24.

4.31 AOI 25 – East Spill Containment Sump

AOI 25 is located east of Plant 3, north of the Plant 3 By-Products Area (AOI 29). AOI 25 consists of the East Spill Containment tank that was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 25 is located outdoors and is paved with concrete. The location of AOI 25 is shown on Drawing 1.2.2. Additional information on AOI 25 is presented in Section 5.25 of the DOCC.

4.31.1 Scope of Investigation

The scope of the RFI at AOI 25 involved the advancement of one soil boring (SB-25-0601) during Phase I to characterize soil and water quality. During Phase II, the advancement of four hand auger soil borings (SB-25-0601R, SB-25-0602, SB-25-0604 and SB-25-0605) was proposed to characterize PCB concentrations previously observed in soil samples collected in this area. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-25-0601 and the hand auger soil borings SB-25-0601R, SB-25-0602, SB-25-0604 and SB-25-0605 were completed in accordance with the RFI Work Plan (November, 2005).

4.31.2 Discussion of Results

4.31.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-25-0601 was advanced in AOI 25 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Two soil samples were collected from the soil boring SB-25-0601 at 1 to 2 ft and 8 to 10 ft bgs and analyzed for VOCs, BNs, PCBs, metals and cyanide (total). Analytical results from the borehole water sample indicate that PCBs and arsenic were detected at concentrations above industrial soil criteria. In addition, arsenic exceeded the migration to groundwater soil criteria. A summary of the soil analytical results are presented in Table 4.1 and Drawings 4.30.1 and 4.31.1.

During Phase II of the RFI, four hand auger soil borings SB-25-0601R, SB-25-0602, SB-25-0604 and SB-25-0605 were advanced to characterize previously identified PCBs in soil samples collected at soil boring SB-25-0601 (1 to 2 ft bgs). As shown in Table 4.1 and Drawings 4.30.1, PCBs were not detected at concentrations above soil screening criteria; therefore, the PCBs are adequately characterized.

4.31.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected from soil boring advanced at SB-25-0601 at approximately 14 ft bgs to investigate water quality in the S1 unit. The borehole water was analyzed for VOCs, BNs, metals and cyanide (total). Ten metals and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.25.2, 4.30.1 and 4.31.1.

4.31.3 Conclusion

Arsenic and PCBs were detected in soil during the RFI above the soil screening criteria within AOI 25. The PCBs were adequately characterized in the soil during Phase II of the RFI. Arsenic exceeded the industrial soil criteria and soil migration to groundwater criteria; however, groundwater from a monitoring well located downgradient from AOI 25 did not contain arsenic concentrations above groundwater screening criteria. Several metals and vinyl chloride were detected in borehole water above the drinking water criteria in the AOI. Downgradient from AOI 25, the metals and vinyl chloride are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 25.

4.32 AOI 26 – Oil Stores and Reclaim Area

The Oil Stores and Reclaim Area is located on the central-west side of the Plant 3 building. AOI 26 includes six SWMUs identified by the USEPA and a Fuel Tank Farm Containment Pit, Oil Reclaim, Oil Stores, four closed in-place USTs, an Aquahouse and the South AST Farm. AOI 26 is located both indoors and outdoors. Activities in the Oil Stores and Reclaim Building are located indoors on a concrete floor. The fuel farms and other areas within the AOI are located outside in areas covered with surficial crushed rock, concrete or asphalt. The location of AOI 26 is shown on Drawing 1.2.2. Additional information on AOI 26 is presented in Section 5.26 of the DOCC. The risk-based screening of pre-RFI data for this AOI, as presented in the DOCC, showed that benzo(a)pyrene, cis-1,2-DCE, iron, PCE, TCE and vinyl chloride concentrations in soil exceeded the industrial volatilization to indoor air or migration to groundwater soil criteria. The pre-RFI data also showed that iron, manganese, methylene chloride, PCE, TCE and vinyl chloride concentrations in groundwater exceeded the drinking water criteria. The pre-RFI data also showed that 1,1,1-TCA, 1,1,2-TCA, 1,1-DCA, 1,1-DCE, arsenic, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, cis-1,2-DCE, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, PCE, TCE and vinyl chloride at concentrations in borehole water exceeded the groundwater criteria. In May 2002 an ERD pilot test was conducted to address the VOCs identified in the groundwater at AOI 26 as discussed in Section 1.3.2.

NAPL observed downgradient from AOI 26 may have originated from historic releases from AOI 26 or from fuel distribution lines originating from AOI 26, and the NAPL is discussed in Section 4.43 as part of the discussion for AOI 40.

4.32.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 26 involved the advancement of soil boring SB-26-0601 to evaluate potential impacts in soil south of the Oil Stores building. Soil boring SB-26-0601 was completed within close proximity of the building wall, where oil staining was observed. In addition, three groundwater samples were collected from monitoring wells MW-0103-S1, MW-0114-S1 and MW-0212-S1 to characterize groundwater quality in sand unit S1.

Soil borings SB-26-0602 and SB-26-0603 were installed between phases of the RFI during an excavation performed by the plant to facilitate installation of a new chemical containment storage area.

During Phase II, three soil borings (SB-26-0604 through SB-26-0606) were advanced to characterize impacted soil identified during Allison renovation activities in May 2006. The location of the soil boring and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. In addition, five monitoring wells (MW-0628-S2, MW-0629-S2, MW-0629-S3, MW-0630-S3 and MW-0630-S4) were installed in sand units S2 and S3 to vertically characterize groundwater impacts previously observed at MW-0103-S1 and downgradient of AOI 26. The sampling and analysis of monitoring wells MW-0629-S2 and MW-0629-S3 is discussed in Section 4.38.

During Phase III, two soil borings (SB-26-0701 and SB-26-0702) were advanced to determine the northern extent of benzene concentrations observed in soil and groundwater west of AOI 26.

The soil borings and monitoring wells were installed and sampled in accordance with the RFI Work Plan (November, 2005). Pre-RFI soil samples collected from within the saturated soil (deeper than approximately 13 ft) are not used in the risk assessment.

4.32.2 Discussion of Results

4.32.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-26-0601 was advanced in AOI 26 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Soil samples were collected from 1 ft to 2 ft bgs and 8 ft to 10 ft bgs and were analyzed for VOCs and BNs. Two soil samples (SB-26-0602 and SB-26-0603) were also collected at 4 ft bgs from the excavation in the Oil Reclaim Building and were

analyzed for VOCs, SVOCs, PCBs and metals. Analytical results from the soil samples indicate that arsenic was detected at concentrations above the migration to groundwater screening criteria and TCE was detected at concentrations above volatilization to indoor air and migration to groundwater screening criteria. A summary of the soil analytical results is presented in Table 4.1 and Drawings 4.31.1 and 4.32.1.

During Phase II, three soil borings (SB-26-0604 through SB-26-0606) were advanced to characterize impacted soil identified during Allison excavation activities. Soil samples were collected from 0.6 ft to 2 ft and 2 ft to 3.5 ft bgs from SB-26-0604; 0.8 ft to 2 ft and 8 ft to 10 ft bgs from SB-26-0605; and 0.8 ft to 2 ft, 2 ft to 4 ft, 8 ft to 10 ft, 14 ft to 15 ft bgs from SB-26-0606. Soil samples were analyzed for VOCs. As shown in Table 4.1 and Drawing 4.32.1, VOCs were not detected at concentrations above soil screening criteria.

During Phase III, two soil borings (SB-26-0701 and SB-26-0702) were advanced to determine the northern extent of benzene in soil located to the west of AOI 26. Soil samples were collected from 14 ft to 15 ft bgs from SB-26-0701 and from 0 ft to 2 ft, 8 ft to 10 ft, 16 ft to 18 ft bgs from SB-26-0702. The soil samples collected from 14 ft to 15 ft bgs from SB-26-0701 and from 16 ft to 18 ft bgs in SB-26-0702 were from saturated sand due to field observations (odor, staining, PID readings). Soil samples were analyzed for VOCs. As shown in Table 4.1 and Drawing 4.32.1, VOCs were not detected at concentrations above soil screening criteria for these samples.

4.32.2.2 Water Investigation

During Phase I of the RFI, three groundwater samples were collected from monitoring wells MW-0103-S1, MW-0114-S1 and MW-0212-S1 to characterize groundwater quality in the S1 unit. The collected groundwater samples were analyzed for VOCs. PCE, TCE and cis-1,2-DCE were detected at concentrations above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.25.2 and 4.32.1.

During Phase II of the RFI, groundwater samples were collected from monitoring wells MW-0628-S2, MW-0630-S3 and MW-0630-S4 and were analyzed for VOCs. VOCs were not detected at concentrations above groundwater screening criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.25.2 and 4.32.1.

During Phase III of the RFI, two borehole water samples were collected from SB-26-0701 and SB-26-0702 and were analyzed for VOCs to characterize benzene concentrations previously observed in the groundwater west of AOI 26. Analytical results from the borehole water sample indicate that benzene was detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.25.2 and 4.32.1.

In addition to the borehole water samples, groundwater samples were collected from monitoring wells MW-0628-S2, MW-0630-S3, MW-0630-S4 and IW-0203. The groundwater samples were analyzed for VOCs. The results for MW-0629-S3 are discussed in Section 4.38. Analytical results from the groundwater samples indicate that 1,1-DCE, 1,1,1-TCA and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.25.2 and 4.32.1.

Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S3) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.32.2 and 4.32.3, respectively.

4.32.3 Conclusion

Arsenic and TCE were detected in soil at concentrations above the soil screening criteria during the RFI within AOI 26. The TCE concentration in soil is adequately characterized during Phase II of the RFI. 1,1-DCE, 1,1,1-TCA, benzene, cis-1,2-DCE, PCE, TCE and vinyl chloride were detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 26, these constituents are bounded downgradient by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 26.

4.33 AOI 27 – Plating Wastewater Sump

AOI 27 is located in the east-central portion of Plant 3. AOI 27 includes the plating wastewater sump (SWMU 34) and a Hazardous Waste Satellite Collection Area (SWMU 9) that were identified by the USEPA in the PA/VSI. A floor-mounted

degreaser was identified during a site visit performed by ARCADIS on September 9, 2004. AOI 27 is located indoors and has a concrete floor. The location of AOI 27 is shown on Drawing 1.2.2. Additional information on AOI 27 is presented in Section 5.27 of the DOCC.

4.33.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 27 involved the advancement of one soil boring (SB-27-0601). Soil and water samples were collected to provide additional characterization data based on historical TPH concentrations in the area. During Phase II, one monitoring well (MW-0631-S1) was installed to characterize groundwater quality. The location of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-27-0601 and monitoring well MW-0631-S1 were completed in accordance with the RFI Work Plan (November, 2005).

4.33.2 Discussion of Results

4.33.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-27-0601 was advanced in AOI 27 to characterize soil VOC concentrations in this area of the site. Soil samples were collected to provide additional characterization data based on historical TPH concentrations in the area. Three soil samples were collected from soil boring SB-27-0601 at 1 ft to 2 ft, 8 ft to 10 ft, and 12 ft to 14 ft bgs and analyzed for VOCs. As shown in Table 4.1 and Drawings 4.30.1 and 4.31.1, VOCs were not detected at concentrations above soil screening criteria.

4.33.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected during the installation of soil boring SB-27-0601 to characterize water quality in the S1 unit. The borehole water sample was collected at approximately 16 ft bgs. The borehole water sample was analyzed for VOCs. Analytical results from the borehole water sample collected indicate benzene and 1,2-dichloroethane (1,2-DCA) were detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawing 4.30.1.

Based on results from Phase I of the RFI, one monitoring well MW-0631-S1 was installed during Phase II to further characterize the water quality in the S1 unit. A

groundwater sample was collected and analyzed for VOCs and BNs. Analytical results from the groundwater sample collected indicate that benzene, cis-1,2-DCE, TCE, vinyl chloride and bis-2-ehtylhexyl)phthalate were detected at concentrations above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawings 4.30.1.

To confirm sample results, an additional groundwater sample was collected from monitoring well MW-0631-S1 between Phase II and Phase III of the RFI. The groundwater sample was analyzed for VOCs. Analytical results from the borehole water samples collected indicate that benzene, cis-1,2-DCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.3 and Drawing 4.30.1.

During Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0631-S1 and analyzed for VOCs and BNs. The groundwater was analyzed VOCs and BNs. Analytical results from the borehole water samples collected indicate that benzene, cis-1,2-DCE, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the groundwater analytical results is presented in Table 4.3 and Drawing 4.30.1.

4.33.3 Conclusion

No constituents were detected in soil during the RFI above the soil screening criteria within AOI 27. Benzene, bis-2-ehtylhexyl)phthalate, cis-1,2-DCE, TCE and vinyl chloride were the only constituents detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 27, these constituents are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 27.

4.34 AOI 28 – Maintenance Garage USTs

The area consists of the Maintenance Garage USTs. The Maintenance Garage USTs are located south of the maintenance garage on the east side of Plant 3 and were closed-in-place prior to 1992. AOI 28 was identified by the USEPA as AOC 3 during the PA/VSI. AOI 28 is located outdoors and is paved with concrete. The location of AOI 28 is shown on Drawing 1.2.2. Additional information on AOI 28 is presented in Section 5.28 of the DOCC.

4.34.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 28 involved the advancement of one soil boring (SB-28-0601) to investigate potential impacts to soil and/or groundwater in the vicinity of the Maintenance Garage USTs. During the installation of soil boring SB-28-0601, field observations indicate potential impacts; therefore, an additional soil boring, SB-28-0602, was advanced south of the USTs. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings (SB-28-0601 and SB-28-0602) were completed in accordance with the RFI Work Plan (November, 2005).

4.34.2 Discussion of Results

4.34.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-28-0601 and subsequently, soil boring SB-28-0602 were advanced in AOI 28 to investigate potential VOC impacts to soil. Four soil samples were collected from the soil boring SB-28-0601 at 0 ft to 2 ft, 4 ft to 6 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs and two soil samples were collected from the soil boring SB-28-0602 at 0 ft to 2 ft and 8 ft to 10 ft bgs. The soil samples were analyzed for VOCs. As shown in Table 4.1 and Drawing 4.30.1, VOCs were not detected at concentrations above soil screening criteria.

4.34.2.2 Water Investigation

Borehole water samples were collected from soil borings SB-28-0601 and SB-28-0602 to characterize water quality. Borehole water samples were collected at approximately 20 ft bgs from SB-28-0601 and at approximately 14.5 ft bgs from SB-28-0602. The borehole water samples were analyzed for VOCs. Analytical results from the borehole water samples collected indicate that 1,1-dichloroethene, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of the borehole water analytical results is presented in Table 4.5 and Drawings 4.25.2 and 4.30.1.

4.34.3 Conclusion

No constituents were detected in soil during the RFI above the soil screening criteria within AOI 28. 1,1-Dichloroethene, TCE and vinyl chloride were the only constituents detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 28, these constituents are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation

discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 28.

4.35 AOI 29 – Plant 3 By-products Area

AOI 29 is located in the eastern portion of Plant 3. The By-products area was identified as SWMU 21 by the USEPA during the PA/VSI. AOI 29 is located indoors and has a concrete floor. The location of AOI 29 is shown on Drawing 1.2.2. Additional information on AOI 29 is presented in Section 5.8 of the DOCC.

4.35.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 29 involved the advancement of three soil borings (SB-29-0601, SB-29-0602 and SB-29-0603) to characterize soil and water quality in this area of the site. These soil borings were completed since the concrete pits associated with the AOI were not able to be properly inspected during the site visit performed by ARCADIS on September 9, 2004.

Monitoring well MW-0629-S2 was installed during Phase II of the RFI to replace monitoring well MW-0411. Monitoring well MW-0411, which had historically received surface infiltration of oil, was located south of AOI 29. MW-0411 was appropriately abandoned between Phase II and Phase III of the RFI. (Since the installation of MW-0629-S2 during the RFI, the AOI that this monitoring well is located in is more appropriately characterized as AOI 32; therefore, discussions regarding the installation and sampling of MW-0629-S2 are presented in Section 4.38). Monitoring well MW-0104 was also proposed to be sampled during Phase II of the RFI. The locations of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-29-0601, SB-29-0602 and SB-29-0603 were completed in accordance with the RFI Work Plan (November, 2005).

4.35.2 Discussion of Results

4.35.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil borings SB-29-0601, SB-29-0602 and SB-29-0603 were advanced in AOI 29 to characterize potential VOC, BN, PCB and metals soil concentrations. Three soil samples were collected from soil borings SB-29-0601 and SB-29-0603 from 1 ft to 2 ft, 8 ft to 10 ft, and 10 ft 12 ft bgs and two soil samples were collected from soil boring SB-29-0602 at 1 ft to 2 ft

and 8 ft to 10 ft bgs. All soil samples were analyzed for VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected indicate that arsenic was detected at a concentration above the migration to groundwater soil criteria. A summary of the soil analytical results is presented in Table 4.1 and Drawings 4.30.1 and 4.31.1.

4.35.2.2 Water Investigation

During Phase I of the RFI, three borehole water samples were collected from soil borings SB-29-0601, SB-29-0602 and SB-29-0603 to characterize water quality in the S1 unit. Borehole water samples were collected at approximately 17 ft bgs from soil borings SB-28-0601 and SB-28-0602 and at 16 ft bgs from soil boring SB-28-0603. The borehole water samples were analyzed for VOCs, BNs, PCBs, and metals. Analytical results from the borehole water samples collected indicate that concentrations of 2-methylnaphthalene, vinyl chloride and 13 metals were detected at concentrations above drinking water criteria. A summary of the soil analytical results is presented in Table 4.5 and Drawings 4.30.1 and 4.31.1.

During Phase II of the RFI, monitoring well MW-0104-S1 was sampled to characterize water quality in the S1 unit. The groundwater sample was analyzed for VOCs, BNs and metals. VOCs, BNs or metals were not detected at concentrations above groundwater screening criteria. A summary of the soil analytical results is presented in Table 4.3 and Drawings 4.30.1 and 4.31.1.

4.35.3 Conclusion

Arsenic was detected above the soil screening criteria during the RFI within AOI 29. Several metals, 2-methylnaphthalene and vinyl chloride were detected in borehole water above the drinking water criteria in the AOI. Downgradient from AOI 29, these constituents are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 29.

4.36 AOI 30 – Copper Strip Area

The Copper Strip Area (AOI 30) is located in the southern portion of Plant 3. The Copper Strip Area was decontaminated and decommissioned in 2003 including removal of the concrete floor slab and some soil, and the subsurface was filled with approximately 10 feet of flowable fill prior to installation of the current floor slab. Soil

excavation was completed as part of retooling of the area and was limited due to operational, time, and budgetary constraints. The limits of excavation are presented in Drawing 4.36.4. AOI 30 consisted of the copper strip and associated tanks that were not identified by the USEPA during the PA/VSI. AOI 30 is located indoors and has a concrete floor. The location of AOI 30 is shown on Drawing 1.2.2. Additional information on AOI 30 is presented in Section 5.30 of the DOCC.

4.36.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 30 included the advancement of three soil borings (SB-30-0601, SB-30-0602, SB-30-0603) and one monitoring well (MW-0609-S2) to characterize chromium exceedances in soil and groundwater identified during previous investigations. During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0609-S2. During Phase III of the RFI, soil boring SB-30-0701 was installed and a groundwater sample was collected from monitoring well MW-0609-S2. The locations of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-30-0601, SB-30-0602, SB-30-0603 and SB-30-0701and monitoring well MW-0609-S2 were completed in accordance with the RFI Work Plan (November, 2005).

4.36.2 Discussion of Results

4.36.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil borings SB-30-0601, SB-30-0602, and SB-30-0603, and monitoring well MW-0609-S2 were installed in AOI 30 to investigate potential chromium concentrations (totals and hexavalent) in soil and groundwater. Three soil samples were collected from soil borings SB-30-0601 and SB-30-0603 at 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs; three soil samples were collected from soil boring SB-30-0602 at 1 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs; and three soil samples were collected from soil boring MW-0609-S2 at 1 ft to 2 ft, 8 ft to 10 ft and 24 ft to 26 ft bgs. The soil sample collected from 24 ft to 26 ft bgs in MW-0609-S2 was from a till unit approximately four feet above the uppermost saturated sand unit at this location. All soil samples were analyzed for total and hexavalent chromium and cyanide. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.36.1.

During Phase III of the RFI, soil boring SB-30-0701 was advanced to further characterize chromium impacts previously detected in soil in this area of the site. Two soil samples were collected from soil boring SB-30-0701 at 8 ft to 10 ft and 10 ft to 12 ft bgs. The soil samples were analyzed for total and hexavalent chromium. Analytical results from the soil samples collected indicate that hexavalent chromium was detected at a concentration above the migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.36.1.

4.36.2.2 Water Investigation

During Phase I of the RFI, one monitoring well MW-0609-S2 was installed to characterize water quality in the S2 unit. Groundwater samples were collected for total and hexavalent chromium analyses. Analytical results from the groundwater sample collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.36.1.

During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0609-S2 to confirm results from Phase I of the RFI and to evaluate potential VOC concentrations in groundwater. The groundwater sample was analyzed for VOCs and metals. Analytical results from the groundwater sample collected indicate TCE and vinyl chloride at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.2 and 4.36.3.

During Phase III of the RFI, monitoring well MW-0609-S2 was re-sampled to verify VOC and metals concentrations observed during Phase II of the RFI. Analytical results from the groundwater sample collected indicate that TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.2 and 4.36.3.

4.36.3 Conclusion

Hexavalent chromium was the only constituent detected above the migration to groundwater soil criteria during the RFI within AOI 30. The nearest downgradient monitoring well, MW-0609-S2B, was analyzed for chromium and no concentrations were detected above the laboratory report limits. TCE and vinyl chloride were the only constituents detected above the drinking water criteria in the AOI. Downgradient from AOI 30, TCE and vinyl chloride are bounded by monitoring wells that do not have

concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 30.

4.37 AOI 31 – Heat Treat Area

The Heat Treat Area (AOI 31) is located in the south-central portion of Plant 3. The Heat Treat Area consisted of ovens, a waste sump, a pit mounted vault and a quench area. A portion of the Heat Treat Area had a basement, which is where the waste sump and vault were historically located. The Heat Treat Area was decommissioned in 2003, including removal of the basement and first floor concrete slabs and some soil, and the entire subsurface was filled with flowable fill (approximately three feet thick over the majority of the area and approximately 10 feet thick where soil was excavated and in the former basement area), prior to installation of the approximately ten inch thick current floor slab. Soil excavation was completed as part of retooling of the area and was limited due to operational, time, and budgetary constraints. AOI 31 is located indoors and has a concrete floor. The location of AOI 31 is shown on Drawing 1.2.2. Additional information on AOI 31 is presented in Section 5.31 of the DOCC.

4.37.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 31 involved the advancement of one soil boring (SB-31-0601) and the installation of one monitoring well (MW-0610-S2) to characterize soil and water quality in the vicinity of (and downgradient from) AOI 31. Phase II of the RFI included the installation of monitoring well MW-0632-S2 and the collection of a groundwater samples from monitoring well MW-0610-S2 (if NAPL was not present). Phase III of the RFI included the installation of soil boring SB-31-0701 in the vicinity of a machine that was draining oil onto the concrete floor. The installation of the soil boring is not associated with the current or former operations at AOI 31. The soil boring was associated with AOI 31 due to it's proximity to the AOI. The location of the soil borings and monitoring wells in AOI 31 are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-31-0601, SB-31-0701 and monitoring wells MW-0610-S2 and MW-0632-S2 were completed in accordance with the RFI Work Plan (November, 2005).

4.37.2 Discussion of Results

4.37.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-31-0601 was advanced in AOI 31 to characterize the presence of PCBs identified during the decommissioning of the Heat Treat Basement. Two soil samples were collected from soil boring SB-31-0601 at 16.5 ft to 16.7 ft and 17 to 19 ft bgs and analyzed for PCBs. Analytical results from the soil samples collected did not indicate PCBs at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.36.2.

During Phase III of the RFI, a soil boring was installed to determine if oil from a floor mounted machine had infiltrated into soil from a joint in the concrete flooring. Soil samples were collected from soil boring SB-31-0701 at 0 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for VOCs. The soil sample was also to be analyzed for BNs; however, this analysis was not completed. During the installation of the soil boring, there was no evidence of staining and no PID detections were identified within the soil boring; however, a slight odor was detected from a core sample from 12 ft bgs. An additional sample to be analyzed for BNs will be collected to confirm characterization of soil at this location. Analytical results from the soil sample collected did not indicate VOC concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.36.2.

4.37.2.2 Water Investigation

During Phase I of the RFI, monitoring well MW-0610-S2 was installed to characterize water quality in the S2 unit. During sampling activities, a NAPL was observed floating on the groundwater in the monitoring well. The NAPL was collected and analyzed for PCBs and “fingerprint” analysis. No PCBs were detected in the NAPL sample at a reporting limit of 0.5 mg/kg. The fingerprint analysis identified the NAPL as a degraded middle distillate (likely diesel or #2 fuel oil). The NAPL is therefore suspected to be the diesel fuel historically released at the Facility and discussed in Section 4.43 AOI 40 Diesel Fuel Recovery System.

During Phase II of the RFI, monitoring well MW-0632-S2 was installed downgradient of AOI 31 to characterize downgradient groundwater quality in the S2 unit. Groundwater samples were scheduled to be collected from monitoring wells MW-0610-S2 and MW-0632-S2 to investigate water quality in the S2 unit. NAPL was again observed in MW-0610-S2; however, a groundwater sample was collected from monitoring well MW-

0632-S2. The groundwater sample was analyzed for VOCs and BNs. Analytical results from the groundwater sample collected indicate that vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.2 and 4.36.3.

During Phase III of the RFI, monitoring wells MW-0610-S2 and MW-0632-S2 were scheduled to be sampled to confirm results from Phase II of the RFI. NAPL was observed in MW-0610-S2; therefore, no water sample was collected from MW-0610-S2. A groundwater sample was collected from MW-0632-S2 and analyzed for VOCs, BNs and arsenic. Analytical results from the groundwater sample collected indicate that arsenic, benzo(b)fluoranthene and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.1, 4.36.2 and 4.36.3.

4.37.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 31. Arsenic, benzo(b)fluoranthene and vinyl chloride were the only constituents detected above the drinking water criteria in the AOI. Downgradient from AOI 31, arsenic, benzo(b)fluoranthene and vinyl chloride are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 31.

4.38 AOI 32 – Department 0384 Plating Area

The Department 0384 Plating Area (AOI 32) was located in the south-central portion of Plant 3. AOI 32 is located adjacent to the east end of the former heat treat area and included the former electroplating area and a mop water station. The area consisted of the Plating Solid Waste CSA (SWMU 2), the Hazardous Waste Satellite Collection Area (SWMU 9) and Plating Wastewater Sumps (SWMU 35) that were identified by the USEPA in the PA/VSI. In addition to the SWMUs identified by the USEPA, AOI 32 included the Cyanide/Copper Plating Line, three Degreasers (floor-mounted), and two Waste Sumps in the electroplating area and a former mop water station. The Plating Area and mop water station were decommissioned in 2003, including removal of the sumps and concrete floor slabs and some soil, and the entire subsurface was filled with flowable fill prior to installation of the floor slab. Soil excavation was completed as part of retooling of the area and was limited due to operational, time, and budgetary constraints. The limits of soil excavation related to the former sumps and mop water

station are presented in Drawing 4.36.4. AOI 32 is located indoors and has a concrete floor. The location of AOI 32 is shown on Drawing 1.2.2. Additional information on AOI 32 is presented in Section 5.32 of the DOCC. The risk-based screening of pre-RFI data for this AOI, as presented in the DOCC, showed that cadmium, chromium, copper, cyanide and PCBs concentrations in soil exceeded the industrial or migration to groundwater soil criteria. The pre-RFI data also showed that no constituents exceeded the drinking water criteria in groundwater; however, 2-methylnaphthalene, arsenic, benzene, bromodichlorodimethane, cis-1,2-DCE, copper, cyanide, dibenzofuran, iron, naphthalene and vinyl chloride exceeded the drinking water criteria in borehole water samples.

4.38.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 32 involved the advancement of three soil borings (SB-32-0601 through SB-32-0603), the installation of monitoring well MW-0611-S2 and the sampling of monitoring wells MW-0611, MW-12, MW-0410 and MW-0412 to characterize soil and water quality in the vicinity of and downgradient from AOI 31. Phase II of the RFI included the installation of two monitoring wells (MW-0629-S2 and MW-0629-S3) to replace existing monitoring well MW-0411. Monitoring well MW-0411, located south of AOI 32, had received historical surface infiltration of oil (as discussed in Section 4.35). In addition, the installation of monitoring wells MW-0629-S2 and MW-0629-S3 should provide vertical profiling of groundwater. During Phase II of the RFI, monitoring wells MW-0410, MW-0412, MW-0611-S2, MW-0629-S2 and MW-0629-S3 were sampled to verify results identified in Phase I of the RFI. Phase III of the RFI included the installation of monitoring well MW-0709-S2 downgradient of AOI 32 and the sampling of monitoring wells MW-0410, MW-0412, MW-0632-S2, MW-16-S2, WM-0629-S2, MW-0629-S3, MW-12 and MW-0709-S2. The location of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.38.2 Discussion of Results

4.38.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), four soil borings (SB-32-0601 through SB-32-0603 and MW-06011-S2) was advanced in AOI 32 to verify if potential metals concentrations were adequately removed during the decommissioning of the Plating Area. Due to a naming error, soil boring SB-32-0603 was renamed SB-

32-0604. Three soil samples were collected from 1 to 2 ft, 8 to 10 ft and 14 to 16 ft bgs from soil boring SB-32-0601; 1 to 2 ft, 8 to 10 ft and 12 to 14 ft bgs from soil boring SB-32-0602, and 1 to 2 ft, 8 to 10 ft and 10 to 12 ft bgs from soil borings SB-32-0604 and MW-0611-S2. All soil samples were analyzed for PCBs, metals and cyanide. Analytical results from the soil samples collected did not indicate PCBs, metals or cyanide at concentrations above soil screening criteria; however, as discussed above, pre-RFI soil data exceeded the industrial or migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.38.1 and 4.38.2.

4.38.2.2 Water Investigation

During Phase I of the RFI, monitoring well MW-0611-S2 was installed to characterize water quality in the S2 unit. Groundwater samples were scheduled to be collected from monitoring wells MW-12-S2, MW-0410-S2, MW-0412-S2 and MW-0611-S2. During sampling activities, NAPL was observed floating on the groundwater in monitoring wells MW-0412-S2 and MW-0611-S2; therefore, no groundwater samples were collected from these monitoring wells during Phase I of the RFI. The NAPL was similar to the NAPL identified in monitoring wells associated with the diesel fuel release. A sample of the NAPL will be collected from this monitoring well during the next groundwater sampling event to characterize the NAPL. Groundwater samples collected from MW-12-S2 and MW-0410-S2 were analyzed for VOCs and metals. Analytical results from the groundwater samples collected indicate that benzene, arsenic and cadmium were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.38.1 and 4.38.2.

In addition, one borehole water sample was collected from soil boring SB-32-0602 from approximately 17 ft bgs. The borehole water sample was analyzed for VOCs and BNs. Benzene and 2-methylnaphthalene were detected at concentrations above the drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.38.1 and 4.38.2.

During Phase II of the RFI, two monitoring wells MW-0629-S2 and MW-0629-S3 were installed to characterize water quality downgradient of AOI 26, AOI 29 and AOI 32 (as previously discussed in Sections 4.20 and 4.23). Groundwater samples were scheduled to be collected from monitoring wells MW-0410-S2, MW-0412-S2, MW-0611-S2, MW-0629-S2 and MW-0629-S3 to verify results obtained during Phase I of the RFI and to characterize groundwater quality within and downgradient of AOI 32.

NAPL was observed in MW-0410-S2 and MW-0412-S2; therefore, no groundwater samples were collected from these monitoring wells during Phase II of the RFI. Because of these wells location in the known extent of the plume resulting from the historic release of diesel fuel, the NAPL is believed to be associated with the historic diesel fuel release and is the historic diesel fuel release is discussed further in Section 4.43. The groundwater samples collected from monitoring wells MW-0611-S2, MW-0629-S2 and MW-0629-S3 were analyzed for VOCs and BNs. The groundwater sample collected from monitoring well MW-0629-S2 was also analyzed for metals. Analytical results from the groundwater samples collected indicate that benzene, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.3, 4.38.1 and 4.38.2.

Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S3) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.32.2 and 4.32.3, respectively.

Between Phase II and Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0629-S3 and analyzed for VOCs to verify the vinyl chloride exceedance identified during groundwater sampling completed as part of Phase II of the RFI. Analytical results from the groundwater sample collected indicate that vinyl chloride was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.3 and 4.38.2.

During Phase III of the RFI, one monitoring well MW-0709-S2 was installed to characterize groundwater quality downgradient of AOI 32. Monitoring wells MW-12-S2, MW-16-S2, MW-0410-S2, MW-0412-S2, MW-0632-S2, MW-0629-S2, and MW-0629-S3 were scheduled to be sampled to confirm results from Phase II of the RFI. NAPL was observed in MW-0412-S2; therefore, no water sample was collected from MW-0412-S2. Because of these wells location in the known extent of the plume resulting from the historic release of diesel fuel, the NAPL is believed to be associated with the historic diesel fuel release and is the historic diesel fuel release is discussed further in Section 4.43. Groundwater samples were collected from MW-0410-S2, MW-0629-S2, MW-0629-S3, MW-0632-S2 and MW-0709-S1and analyzed for VOCs. Groundwater samples were collected from MW-12-S2, MW-0629-S2 and MW-0632-S2

and analyzed for arsenic (total and/or dissolved). Results from MW-0632-S2 are discussed in Section 4.37. Analytical results from the groundwater samples collected indicate that benzene, cis-1,2-DCE, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.36.3, 4.38.1 and 4.38.2.

4.38.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 32. Benzene, cis-1,2-DCE, TCE and vinyl chloride were detected above the drinking water criteria in the AOI. Downgradient from AOI 32, these constituents are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 32.

4.39 AOI 33 – Mop Water Stations

The Mop Water Stations (AOI 33) are located throughout Plant 3 and Plant 12/14. Mop Water Stations and dump stations have been removed from service and relocated at several locations at the Site. The Mop Water Stations are located indoors and are constructed with concrete. At the time of the DOCC, 19 Mop Water Stations existed at the Facility, two of which were located within other AOIs (AOI 13 and AOI 46). Since there are several locations for the Mop Water Stations, those that are not within an existing AOI have been designated as AOI 33A, AOI 33B, etc. The locations of the Mop Water Stations (AOI 33A, AOI 33B, etc) are shown on Drawing 1.2.2. The summary of the analytical data is presented as one AOI on the screening tables and the analytical databoxes are presented as spatially appropriate throughout the Facility. Additional information on AOI 33 is presented in Section 5.33 of the DOCC.

4.39.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 33 involved the advancement of four soil borings (SB-33-0601 through SB-33-0604) downgradient of selected mop water stations. An additional soil boring was advanced at AOI 33E. Soil and borehole water samples were collected to characterize soil and water quality in the vicinity of these mop water stations. Phase II of the RFI included the installation of three soil borings in the vicinity of Mop Water Station AOI 33E and two monitoring wells (MW-0633 and MW-0634-S2) downgradient of the mop water stations located at AOI 33A and AOI

33E. Phase III of the RFI included resampling monitoring wells MW-0633-S2 and MW-0634-S2B to confirm concentrations identified during Phase II of the RFI. The location of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and the monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.39.2 Discussion of Results

4.39.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil borings SB-33-0601 through SB-33-0604 (and subsequently SB-33-0605) were advanced to determine soil quality in the vicinity of selected mop water stations. Soil samples were collected from 1 ft to 2 ft, 8 ft to 10 ft, 10 to 12 ft and 14 to 16 ft bgs from SB-33-0601; 1 ft to 2 ft bgs from SB-33-0602; 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from SB-33-0603; 1 ft to 2 ft, 8 ft to 10 ft and 14 ft to 16 ft bgs from SB-33-0604; and 1 ft to 2 ft and 8 ft to 10 ft bgs from SB-33-0605. Soil samples were analyzed for VOCs, BNs, metals and cyanide. Analytical results from the soil samples collected indicate PCE was detected at a concentration above the industrial volatilization to indoor air and/or migration to groundwater soil criteria at AOI 33E. None of the other mop water stations that were investigated exhibited sample concentration exceeding soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.31.1 and 4.31.2 for AOI 33A, 4.22.1 and 4.25.1 for AOI 33B, 4.25.1 and 4.31.1 for AOI 33C and 4.39.1 and 4.39.2 for AOI 33D and AOI 33E.

During Phase II of the RFI, three soil borings (SB-33-0606, SB-33-0607 and SB-33-0608) were advanced to characterize PCE concentrations identified during Phase I of the RFI. During installation, SB-33-0607 was converted to a monitoring well and the name changed to MW-0634-S2. Soil samples were collected from 0.8 ft to 2 ft and 8 ft to 10 ft bgs from SB-33-0606 and from 0.8 ft to 2 ft, 8 ft to 10 ft; 22 ft to 24 ft bgs from SB-33-0608. Soil samples were analyzed for VOCs. Analytical results from the soil samples collected indicate PCE was detected at concentrations above the industrial volatilization to indoor air and/or migration to groundwater soil criteria.

4.39.2.2 Water Investigation

During Phase I of the RFI, borehole water samples were collected from the five soil borings and analyzed for VOCs, BNs, metals and cyanide. Analytical results from the borehole water samples collected indicate that PCE, bis(2-ethylhexyl)phthalate and 14 metals were detected at concentrations above drinking water criteria. None of the

other mop water stations investigated contained samples that exceeded groundwater screening criteria. A summary of soil analytical results are presented in Table 4.5 and Drawings 4.31.1 and 4.31.2 for AOI 33A, 4.22.1 and 4.25.1 for AOI 33B, 4.25.1 and 4.31.1 for AOI 33C and 4.39.1 and 4.39.2 for AOI 33D and AOI 33E. .

During Phase II of the RFI, two monitoring wells, MW-0633-S2 and MW-0634-S2B, were installed downgradient of AOI 33A and AOI 33E, respectively, to characterize downgradient groundwater quality. The groundwater sample from MW-0633-S2 was analyzed for metals. The groundwater sample from MW-0634-S2B was analyzed for VOCs and metals. Analytical results from the groundwater samples collected did not indicate concentrations of metals and/or VOCs above groundwater screening criteria. A summary of groundwater analytical results are presented in Tables 4.3 and Drawings 4.31.1 and 4.31.2 for AOI 33A and 4.39.1 and 4.39.2 for AOI 33E.

During Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0633-S2 and MW-0634-S2B to confirm results observed from Phase II of the RFI. The groundwater sample from MW-0633-S2 was analyzed for total and dissolved metals. The groundwater sample from MW-0634-S2B was analyzed for total metals. Analytical results from the groundwater samples collected indicate that manganese was detected at a concentration above drinking water criteria in AOI 33A. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.31.1 and 4.31.2 for AOI 33A and 4.39.1 and 4.39.2 for AOI 33E.

4.39.3 Conclusion

PCE was detected in soil in AOI 33E during the RFI above the soil volatilization to indoor air and/or soil migration to groundwater criteria. However, the concentrations have a decreasing concentration trend as soil sample locations extend away from the limits of AOI 33E; therefore, soil is adequately characterized. Total manganese was detected above the drinking water criteria in AOI 33A; however, the concentration only slightly exceeds the drinking water criteria (1.2 times) and manganese was not detected in the dissolved sample above the groundwater screening criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 33.

4.40 AOI 35 – Scrap Metal Storage

The Scrap Metal Storage Area (AOI 35) is located south of Plant 3. AOI 35 consists of two scrap metal storage areas, one of which was identified as SWMU 18 by the

USEPA during the PA/VSI. AOI 35 is located outdoors and is paved with concrete. The location of AOI 35 is shown on Drawing 1.2.2. Additional information on AOI 35 is presented in Section 5.35 of the DOCC.

4.40.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 35 involved the advancement of soil boring SB-35-0601 to characterize soil quality south of the northern storage area, which exhibited staining (on concrete) and cracked concrete The location of the soil boring is illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil boring SB-35-0601 was advanced in accordance with the RFI Work Plan (November, 2005).

4.40.2 Discussion of Results

4.40.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-35-0601 was advanced in AOI 35 to investigate the presence of VOCs, BNs, PCBs and metals in soil. Three soil samples were collected from soil boring SB-35-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 12 ft and 14 ft bgs and analyzed for VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected indicate benzo(a)pyrene was detected at a concentration above the industrial soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.40.1 and 4.40.2.

4.40.3 Conclusion

Benzo(a)pyrene was detected above the industrial soil criteria during the RFI within AOI 35; however, the concentration only slightly exceeds the industrial soil criteria (2.0 times). The soil boring SB-35-0601 was located downgradient of the most likely impacted portion of the AOI (i.e. cracked concrete). Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at AOI 35.

4.41 AOI 36 – Drum Storage Building Area

The Drum Storage Building Area is located outside of Plant 3 adjacent to the southeast corner of the building and due east of the Scrap Metal Storage Area (AOI 35). AOI 36 includes SWMU 1 identified by the USEPA during the PA/VSI and a waste sump and drum storage area that were identified during the ARCADIS site walk performed on

September 9, 2004. AOI 36 is located outdoors and is paved with concrete. The location of AOI 36 is shown on Drawing 1.2.2. Additional information on AOI 36 is presented in Section 5.36 of the DOCC.

4.41.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 36 involved the advancement of soil boring SB-36-0601 to characterize soil and water quality due to the presence of cracks and staining on the concrete. Due to refusal twice at four ft bgs, the location was off-set to the west in an attempt to complete the soil boring. The new location was identified as SB-36-0602; however, refusal was encountered three times at four ft bgs. Due to the refusal at two locations, no borehole water samples were collected during the RFI. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings were completed in accordance with the RFI Work Plan (November, 2005).

4.41.2 Discussion of Results

4.41.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-36-0601, and subsequent soil boring SB-36-0602 were advanced in AOI 36 to investigate the presence of VOCs, BNs, metals and cyanide in soil. A soil sample was collected from SB-36-0601 from 1 ft to 2 ft bgs and analyzed for VOCs, BNs, metals and cyanide. Analytical results from the soil sample collected did not indicate constituents of concern at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.40.1 and 4.40.2.

4.41.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 36. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at AOI 36.

4.42 AOI 38 – AST Farm

The AST Farm is located south of Plant 3 between the Construction Debris Staging Area (AOI 37) and the AST (AOI 39). AOI 38 was identified as SWMU 16 by the USEPA during the PA/VSI. In the PA/VSI, SWMU 16 was listed as a storage area for

used oil; however, based on interviews with Plant personnel, these ASTs contain used oil and raw materials (methanol, diesel fuel, etc.). Used oil was also stored in the 200,000-gallon AST (AOI 39) located to the east of the AST Farm. AOI 38 is located outdoors and has a concrete floor with a grass perimeter that is regularly mowed. The location of AOI 38 is shown on Drawing 1.2.2. Additional information on AOI 38 is presented in Section 5.38 of the DOCC.

4.42.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 38 involved the advancement of two soil borings (SB-38-0601 and SB-38-0602) to characterize soil quality. The location of the soil borings are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings were advanced in accordance with the RFI Work Plan (November, 2005).

4.42.2 Discussion of Results

4.42.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil borings SB-38-0601 and SB-38-0602 were advanced in AOI 38 to investigate the presence of PCBs in soil. Soil samples were collected from 1 ft to 2 ft, 8 ft to 10 ft and 18 ft to 20 ft bgs from soil boring SB-38-0601 and from 0 ft to 2 ft, 8 ft to 10 ft and 18 ft to 20 ft bgs from SB-38-0602. The soil samples were analyzed for PCBs. Analytical results from the soil samples collected did not indicate PCBs at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.40.1.

4.42.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 38. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at AOI 38.

4.43 AOI 40 – Diesel Fuel Release

The incident associated with AOI 40 was a release of diesel fuel from a transfer line between the south fuel farm (AOI 26) and the Engineering Test Cells (AOI 13). The release was identified in 1972 when a diesel fuel was observed seeping into Big Eagle

Creek. AOI 40 was identified as AOC2 by the USEPA in the PA/VSI. The release area is within Plant 3; however, the diesel fuel impacted groundwater extends both on- and off-site to the south where it discharges into the Big Eagle Creek, and to the east. The location of AOI 31 is shown on Drawing 1.2.2. An on-going groundwater recovery system is in place and is discussed in Section 1.3.3. Additional information on AOI 40 is presented in Section 5.40 of the DOCC.

In August 2005 GM received a call from a resident at 4050 Vermont Street concerned about the quality of the water from the property water well. Although the location is approximately 1,500 feet from any identified diesel fuel impacts to groundwater and therefore no impacts from the historic release of diesel fuel at the Facility were expected to be present in the water supply well at the property, GM contacted the Marion County Health Department (MCHD) and requested that MCHD collect and analyze a water sample from the property. GM split the sample with MCHD and analyzed the sample for TPH-ERO. MCHD analyzed the sample for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride), VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes), metals (arsenic, barium, cadmium, chromium, mercury and lead) and herbicides/pesticides (atrazene, alachlor, cyanazine, metolachlor, simazine, aldicarb, carbaryl, carbofuran and methomyl).

Additionally, between 1997 through 2002, MCHD was contacted by five residences to conduct water sampling of their private water well. MCHD collected the water samples from various sample points that included indoor and outdoor faucet locations. MCHD analyzed the water samples for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride) and metals (arsenic, barium, cadmium, chromium, mercury and lead). In addition, MCHD analyzed two of the five water samples from the residences for VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes).

4.43.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 40 involved an off-site soil investigation to characterize the extent of NAPL on the groundwater, installation of several monitoring wells off-site and groundwater sampling of several existing monitoring wells to determine the extent of off-site impacts from the diesel fuel release. Soil samples collected during Phase I were collected from the saturated/smear zone and thus are not representative of actual soil concentrations, but are used to aid in characterizing the groundwater conditions and therefore, are not used in the risk assessment. Phase

II of the RFI involved the collection of groundwater samples from monitoring wells MW-0104-S2, MW-16-S2, MW-0632 (this well is associated with AOI 31; therefore, results are discussed in Section 4.37), MW-0105-S2, MW-0106-S2A (if NAPL was present in MW-0106-S2S, sample MW-0116) and MW-0624-S2A to characterize VOCs, BNs and arsenic. Phase III of the RFI proposed the collection of groundwater samples from MW-30-S2, MW-31-S2, MW-32-S2, MW-0105-S2 (if no NAPL is present), MW-0522-S2A, MW-0523-S2, MW-0524-S2A and MW-0623-S2A to confirm results from Phase II of the RFI. NAPL was present in MW-0105-S2 and MW-0623-S2A during Phase III. Water samples were also collected from the recovery wells (BW-4 through BW-12) associated with the remediation system to evaluate performance of the system. The water samples collected from the recovery wells are used for performance monitoring of the IM and are not intended to be used to evaluate groundwater concentrations with respect to the risk assessment but the data are discussed in Section 4.43.2.2. As discussed in Section 5.2.1, only groundwater data from monitoring wells are used to evaluate potential exposure. The location of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and the monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.43.2 Discussion of Results

4.43.2.1 Soil Investigation

Prior to Phase I of the RFI, twelve soil borings (SB-40-0501 through SB-40-0512) were advanced in an off-site neighborhood to characterize the sheen observed on the groundwater in monitoring wells MW-24-S2A, MW-30-S2, MW-34-S2, MW-0104-S2, and MW-0107-S2 associated with AOI 40. Due to the presence of a stained soil layer at and above the water table (smear zone) and previous analyses of groundwater samples did not detect concentrations of specific constituents above drinking water criteria, it was intended that soil samples would be collected from the smear zone and analyzed for VOCs, BNs, total petroleum hydrocarbons – diesel range organics (TPH-DRO) and TPH-gasoline range organics (TPH-GRO). Analytical results from the soil samples collected indicate 2-methylnaphthalene and naphthalene were detected at concentrations above the industrial and/or volatilization to indoor air soil criteria, however, since these soil samples were collected from the saturated/smear zone they are not representative of actual soil concentrations and are not used in the risk assessment. A summary of soil analytical results are presented in Tables 4.1 and 4.2 for on-site and off-site, respectively, and Drawings 4.43.1 and 4.43.2.

4.43.2.2 Water Investigation

In August 2005, prior to the RFI, a water sample was collected from the kitchen faucet in conjunction with the Marion County Health Department. GM analyzed the water sample for TPH-ERO. The water sample did not contain concentrations of TPH-ERO above the laboratory reporting limits. MCHD analyzed the sample for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride), VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes) and metals (arsenic, barium, cadmium, chromium, mercury and lead). Nitrate, chloride, sulfate and barium were only the constituents detected above the laboratory reporting limits; however, the concentrations were below the MCL or the non-enforceable health standards recommended by MCHD (analytical results provided in Appendix I). A summary of the off-Site TPH analytical results are presented in Drawing 4.43.2.

Additionally, between 1997 through 2002, MCHD was contacted by five residences to conduct water sampling of their private water wells. MCHD collected the water samples from various sample points that included indoor and outdoor faucet locations. MCHD analyzed the water samples for anions (nitrate as nitrogen, nitrite, chloride, sulfate and fluoride) and metals (arsenic, barium, cadmium, chromium, mercury and lead). Nitrate, nitrite, chloride, sulfate, fluoride, arsenic, barium, chromium, and lead were detected above the laboratory reporting limits; however, the concentrations were below the MCL or the non-enforceable health standards recommended by MCHD for all analytes (analytical results provided in Appendix I). MCHD analyzed two of the five water samples from the residences for VOCs (benzene, 1,2-DCA, methyl ethyl ketone, PCE, tetrahydrofuran, toluene, 1,1,1-TCA, TCE, total trihalomethanes and xylenes). None of the VOCs were detected above the laboratory reporting limits.

Prior to Phase I of the RFI, eight monitoring wells MW-0522-S2A, MW-0522-S2B, MW-0523-S2, MW-0524-S2A, MW-0524-S2B, MW-0525-S2, MW-0526-S2A and MW-0526-S2B were installed to determine if the NAPL extended into the residential neighborhood southeast of the Site. No groundwater samples were collected from these monitoring wells at this time. The historical thickness of NAPL identified in monitoring wells in the vicinity of AOI 40 is presented in Drawing 4.43.3.

During Phase I of the RFI, two soil borings (SB-40-0513 and SB-40-0514) were advanced south of Big Eagle Creek to confirm that impacts related to the diesel fuel release were not present south of the creek. Borehole water samples were collected from the soil borings and analyzed for VOCs, BNs and TPH– extended range organics

(TPH-ERO). Analytical results from the borehole water samples collected did not indicate constituents of concern at concentrations above groundwater screening criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.43.1.

In addition, Phase I of the RFI proposed groundwater samples be collected from the eight monitoring wells installed in the neighborhood, in addition to monitoring wells MW-28-S2, MW-30-S2, MW-32-S2, MW-33-S2, MW-34-S2, MW-0104-S2, MW-0107-S2, MW-0410 and MW-0412. During sampling activities, a NAPL was observed floating on the groundwater in monitoring well MW-0526-S2A. The NAPL was collected and submitted to Zymax Forensics for fingerprint analysis. The NAPL was similar to the NAPL identified in monitoring wells associated with the diesel fuel release. The groundwater samples that were collected were analyzed for VOCs and BNs. Analytical results from the groundwater samples indicate that bis(2-ethylhexyl)phthalate was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.40.1 and 4.43.1.

Between Phase I and Phase II of the RFI, four monitoring wells (MW-0622-S2A, MW-0623-S2A, MW-0624-S2A and MW-0625-S2A) were installed to characterize the presence of NAPL identified in monitoring well MW-0526-S2A. No groundwater samples were collected at this time.

During Phase II of the RFI, groundwater samples were scheduled to be collected from monitoring wells MW-0104-S2, MW-16-S2, MW-0632 (this well is associated with AOI 31; therefore, results are discussed in Section 4.37), MW-0105-S2, MW-0106-S2A (if NAPL was present in MW-0106-S2S, sample MW-0116) and MW-0624-S2A. The groundwater samples were analyzed for VOCs, BNs and/or arsenic. Analytical results from the groundwater samples collected indicate that arsenic, benzo(a)pyrene, benzo(a)anthracene, benzo(a)fluoranthene and indeno(1,2,3-cd)pyrene were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.40.1, 4.40.2 and 4.43.1.

During Phase III of the RFI, monitoring wells MW-30-S2, MW-31-S2, MW-32-S2, MW-0105-S2 (if no NAPL is present), MW-0522-S2A, MW-0523-S2, MW-0524-S2A and MW-0623-S2A were scheduled to be sampled to confirm results from Phase II of the RFI. NAPL was observed in MW-0105-S2 and MW-0623-S2A; therefore, no water sample was collected from these monitoring wells. Groundwater samples were collected from the remaining monitoring wells (MW-30-S2, MW-31-S2, MW-32, MW-

0522-S2A, MW-0523-S2 and MW-0524-S2A) and analyzed for VOCs, BNs, TPH-ERO, and/or arsenic. Analytical results from the groundwater samples collected indicate that arsenic was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Tables 4.3 and 4.4 for on-site and off-site, respectively, and Drawing 4.40.1, 4.40.2 and 4.43.1.

4.43.3 Conclusion

Naphthalene and 2-methylnaphthalene were detected at concentrations above the industrial and/or volatilization to indoor air soil screening criteria in one or more soil borings during the RFI. However, the soil samples were collected from the saturated/smear zone and therefore they are not representative of vadose zone soil concentrations. Arsenic, benzo(a)pyrene, benzo(a)anthracene, benzo(a)fluoranthene, bis(2-ethylhexyl)phthalate, and indeno(1,2,3-cd)pyrene were detected above the drinking water criteria in the AOI. Groundwater in the uppermost, continuous saturated unit (S2) at the Facility (including AOI 40) discharges to Big Eagle Creek. NAPL has been identified as a sheen or a measurable thickness on the groundwater surface in monitoring wells used to characterize AOI 40. An interim measures system (groundwater extraction) is located downgradient from a majority of the monitoring wells used to characterize AOI 40 and minimizes any seepage of diesel fuel sheen (NAPL) into Big Eagle Creek. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 40.

4.44 AOI 42 – Plant 14 Heat Treat Area

The Heat Treat Area is located in the northwest portion of the Plant 14 building northwest of AOI 43. The Plant 14 Heat Treat Area was not identified by the USEPA in the PA/VSI and contained three pit mounted degreasers, a floor mounted PCE Still, a process waste sump and the heat treat processing area. AOI 42 is located indoors and has a concrete floor. The location of AOI 42 is shown on Drawing 1.2.2. Note this is an industrial work place regulated under OSHA, as discussed in Section 1.2.3. Additional information on AOI 42 is presented in Section 5.42 of the DOCC.

4.44.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 42 included the advancement of three soil borings (SB-42-0601 through SB-42-0603). Soil boring SB-42-0604 was completed to replace soil boring SB-42-0601, as refusal was encountered and planned

soil boring termination depth (at soil boring SB-42-0601) could not be achieved. These soil borings were installed to investigate soil and water quality in the vicinity of the former degreasers. During Phase II of the RFI, four soil borings (SB-42-0605 through SB-42-0608) and five monitoring wells (MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B and MW-0636-S3) were installed. Groundwater samples were collected from monitoring wells MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B and MW-0636-S3 to investigate groundwater quality in the vicinity of AOI 42. Between Phase II and Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0636-S2A, MW-0636-S2B and MW-0636-S3 to verify results from Phase II of the RFI. During Phase III of the RFI, six soil borings (SB-42-0701 through SB-42-0706) were installed and two monitoring wells (MW-0707-S2B and MW-0708-S2A) were installed. Soil borings SB-42-0701 and SB-42-0702 were completed as temporary piezometers to determine if NAPL was present above the confining till unit. Groundwater samples were subsequently collected from monitoring wells MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B, MW-0636-S3, MW-0707-S2B and MW-0708-S2A. The locations of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.44.2 Discussion of Results

4.44.2.1 Soil Investigation

During Phase I of the RFI, soil borings SB-42-0601, SB-42-0602, SB-42-0603, and SB-42-0604 were installed in AOI 42 to investigate soil and groundwater in the vicinity of former degreasers. Soil samples were collected from 1 ft to 2 ft bgs at soil boring SB-42-0601; from 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from soil boring SB-42-0602; from 1 ft to 2 ft and 8 ft to 10 ft bgs from soil boring SB-42-0603; and from 1 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil boring SB-42-0604. All soil samples were analyzed for VOCs. Analytical results from the soil samples collected indicate PCE was detected at concentrations above the industrial, volatilization to indoor air and/or migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.44.1.

During Phase II of the RFI, soil borings SB-42-0605 through SB-42-0608 were advanced to further characterize VOC concentrations identified during Phase I of the RFI. Soil samples were collected from 0.8 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil borings SB-42-0605 through SB-42-0608. All soil samples were analyzed for

VOCs. Analytical results from the soil samples collected indicate PCE was detected at a concentration above the industrial, volatilization to indoor air and/or migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.44.1.

During Phase III of the RFI, soil borings SB-42-0701 through SB-42-0706 were advanced to further characterize VOC concentrations identified during Phase II of the RFI. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft, 22 ft to 24 ft and 30 ft to 32 ft bgs from soil boring SB-42-0701; from 0 ft to 2 ft, 8 ft to 10 ft and 22 ft to 24 ft bgs from soil boring SB-42-0702; from 0 ft to 2 ft, 8 ft to 10 ft, 14 ft to 15 ft bgs from soil borings SB-42-0703 and SB-42-0704; from 0 ft to 2 ft and 8 ft to 10 ft bgs from soil borings SB-42-0705 and SB-42-0706. Due to a very high concentration (7.11 mg/l) of PCE in the initial groundwater sample from MW-0636-S2B soil samples were collected from 22 ft to 24 ft and 30 ft to 32 ft bgs in soil boring SB-42-0701 and 22 ft to 24 ft bgs in soil boring SB-42-0702, which are at depths beneath the uppermost saturated unit or between saturated units in order to characterize potential migration of PCE. All soil samples were analyzed for VOCs. Analytical results from the soil samples collected indicate PCE was detected at a concentration above volatilization to indoor air soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.44.1.

PCE concentration contours in soil for AOI 42 are presented in Drawing 4.44.2

4.44.2.2 Water Investigation

During Phase I of the RFI, borehole water samples were collected from soil borings SB-42-0602 through SB-42-0604 to characterize water quality in the vicinity of AOI 42. Borehole water samples were collected from approximately 20 ft bgs at soil boring SB-42-0602, approximately 16 ft bgs at soil boring SB-42-0603 and approximately 18 ft bgs at soil boring SB-42-0604. Borehole water samples were collected and analyzed for VOCs. Analytical results from the borehole water samples collected indicate PCE and TCE were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.44.1.

During Phase II of the RFI, five monitoring wells (MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B and MW-0636-S3) were installed to characterize impacts identified during Phase I of the RFI. Groundwater samples were collected from monitoring wells MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B and MW-0636-S3 and analyzed for VOCs. Analytical results from the groundwater samples

collected indicate cis-1,2-DCE, PCE and TCE were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.44.1.

Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S3) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.32.2 and 4.32.3, respectively.

Between Phase II and Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0636-S2A, MW-0636-S2B and MW-0636-S3 to verify results from Phase II of the RFI. The groundwater samples were analyzed for VOCs. Analytical results from the groundwater samples collected indicate PCE and TCE were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.44.1.

During Phase III of the RFI, two monitoring wells (MW-0707-S2B and MW-0708-S2A) were installed to further characterize the downgradient extent of previously detected groundwater VOC and metals concentrations. In addition, two temporary piezometers were installed to evaluate the presence or absence of a NAPL above the confining till unit. NAPL has not been identified within the piezometers. Groundwater samples were collected from monitoring wells MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B, MW-0636-S3, MW-0707-S2B and MW-0708-S2A. Groundwater samples from monitoring wells MW-0635-S2, MW-0635-S3, MW-0636-S2A, MW-0636-S2B and MW-0636-S3 were analyzed for VOCs. Groundwater samples from MW-0707-S2B and MW-0708-S2A were analyzed for VOCs and metals. Analytical results from the groundwater samples collected indicate arsenic, cis-1,2-DCE, trans-1,2-DCE, methylene chloride, PCE and TCE were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.44.1 and 4.44.3.

4.44.3 Conclusion

PCE was detected in soil above the industrial soil criteria, volatilization to indoor air soil criteria and/or soil migration to groundwater criteria during the RFI in one or more soil borings within AOI 42; however, the concentrations show a decreasing concentration trend to the north, west, and east from the likely source of PCE within AOI 42. AOI 43 -

Plant 14 Cyanide/Copper Plating is directly south of AOI 42 and is discussed in Section 4.45. Arsenic, cis-1,2-DCE, trans-1,2-DCE, methylene chloride, PCE and TCE were the only constituents detected in groundwater above the drinking water criteria in the AOI. Downgradient from AOI 42, these constituents are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 42.

4.45 AOI 43 – Plant 14 Cyanide/Copper Plating Area

The Cyanide/Copper Plating Area is located in the north-central portion of the Plant 14 building due east of AOI 44. Several areas were identified by the USEPA: the PCE still area (SWMU 8), a hazardous waste satellite collection area (SWMU 9) and a plating wastewater sump (SWMU 33). Three pit mounted degreasers were also included in this AOI but were not identified by the USEPA. AOI 43 is located indoors and has a concrete floor. The location of AOI 43 is shown on Drawing 1.2.2. Note this is an industrial work place that is regulated under OSHA, as discussed in Section 1.2.3. Additional information on AOI 43 is presented in Section 5.43 of the DOCC.

4.45.1 Scope of Investigation

The scope of the Phase I RFI at AOI 43 involved the installation of three monitoring wells (MW-0612-S2B, MW-0613-S2A and MW-0614-S2B) to investigate soil and groundwater quality in the vicinity of and downgradient from AOI 43. Phase II of the RFI included the advancement of two soil borings (SB-43-0601 and SB-43-0602) and the installation of two monitoring wells (MW-0637-S2B and MW-0637-S3) to investigate groundwater quality to the southeast of AOI 43. Phase III of the RFI involved the collection of groundwater samples from monitoring wells MW-0637-S2B, MW-0637-S3, MW-0707-S2B and MW-0708-S2A. The results of groundwater sampling associated with monitoring wells MW-0707-S2B and MW-0708-S2A are discussed in Section 4.44. The location of the soil borings and monitoring wells are illustrated on Drawing 1.1.2 and the boring logs are provided in Appendix B. The soil borings and the monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.45.2 Discussion of Results

4.45.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil samples were collected to investigate soil quality in the vicinity of and downgradient from AOI 43. Soil samples were collected from 1 ft to 2 ft, 8 ft to 10 ft and 22 ft to 24 ft bgs from monitoring wells MW-0612-S2B and MW-0614-S2B and from 1 ft to 2 ft and 8 ft to 10 ft bgs from monitoring well MW-0613-S2A. Soil samples were analyzed for VOCs, BNs, metals and cyanide. Analytical results from the soil samples collected indicate that PCE was detected at concentrations above the volatilization to indoor air soil screening criteria and arsenic was detected at a concentration above the industrial and migration to groundwater soil criteria in monitoring well MW-0613-S2A; however the soil concentration in the field duplicate was not detected at a concentration above the industrial and migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.39.1 and 4.39.2.

During Phase II of the RFI, two soil borings (SB-43-0601 and SB-43-0602) were advanced to further characterize VOC concentrations identified during Phase I of the RFI. Soil samples were collected from 0.8 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil boring SB-43-0601 and from 0.8 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from soil boring SB-43-0602. Soil samples were analyzed for VOCs. Analytical results from the soil sample collected indicate PCE was detected at a concentration above the industrial, volatilization to indoor air and/or migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.39.1.

PCE concentration contours in soil for AOI 42 are presented in Drawing 4.44.2

4.45.2.2 Water Investigation

During Phase I of the RFI, monitoring wells MW-0612-S2B, MW-0613-S2A and MW-0614-S2B were installed to characterize groundwater quality. Groundwater samples collected from these three monitoring wells were analyzed for VOCs, BNs, metals and cyanide. Analytical results from the groundwater samples collected did not indicate VOCs at concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.39.1 and 4.39.2.

During Phase II of the RFI, monitoring wells MW-0637-S2B and MW-0637-S3 were installed to characterize groundwater quality downgradient from AOI 43. Groundwater

samples were collected from MW-0637-S2B and MW-0637-S3 and analyzed for VOCs, BNs, metals and cyanide. Analytical results from the groundwater samples collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.39.1 and 4.39.2.

During Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0637-S2B, MW-0637-S3, MW-0707-S2B and MW-0708-S2A to confirm the results from Phase II of the RFI. Groundwater samples from monitoring wells MW-0637-S2B and MW-0637-S3 were analyzed for VOCs. Groundwater samples from monitoring wells MW-0707-S2B and MW-0708-S2A were analyzed for metals. Groundwater results from the sampling of MW-0707-S2B and MW-0708-S2A are discussed in Section 4.44.2.2. Analytical results from the groundwater samples collected did not indicate VOCs at concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.39.1 and 4.39.2.

Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S3) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.32.2 and 4.32.3, respectively.

4.45.3 Conclusion

PCE was detected at concentrations above the industrial soil criteria, volatilization to indoor air soil criteria and/or soil migration to groundwater criteria during the RFI at AOI 43; however, the concentrations show a decreasing concentration trend south, east and west from the likely source of PCE within AOI 43. AOI 42 - Plant 14 Heat Treat is directly north of AOI 42 and is discussed in Section 4.44. Arsenic was detected in soil at a concentration above the industrial soil criteria and migration to groundwater soil criteria in monitoring well MW-0613-S2A; however, the soil concentration in the field duplicate was not detected at a concentration above the soil screening criteria. No constituents were detected above the drinking water criteria from monitoring wells associated with this AOI. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 43.

4.46 AOI 45 – Swarf and Shot Peening Storage Area

The Swarf and Shot Peening Storage Area is located outside of Dock 120 at the northwest corner of Plant 12. The extent of AOI 45 includes the Swarf and Shot Peening Storage Area, identified by the USEPA as SWMU 12 and the chip handling/process waste pit that was not identified by the USEPA in the PA/VSI. AOI 45 is located outdoors and is paved with concrete and asphalt. The location of AOI 45 is shown on Drawing 1.2.2. Additional information on AOI 45 is presented in Section 5.45 of the DOCC.

4.46.1 Scope of Investigation

The scope of the RFI at AOI 45 involved the advancement of soil boring SB-45-0601 to characterize soil and water quality in the vicinity of documented releases in this area of the Site. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. The soil boring was completed in accordance with the RFI Work Plan (November, 2005).

4.46.2 Discussion of Results

4.46.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-45-0601 was advanced in AOI 45 to investigate soil quality in the vicinity of documented releases in the Department 1207 By-Products area (AOI 46). Three soil samples were collected from soil boring SB-45-0601 at 0 ft to 2 ft, 8 ft to 10 ft and 18 ft to 20 ft bgs. The soil samples were analyzed for VOCs, BNs and metals. Analytical results from the soil samples collected did not indicate constituents of concern at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.46.1 and 4.46.2.

4.46.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected from soil boring SB-45-0601 to investigate water quality in the vicinity of AOI 45. The borehole water sample was collected at approximately 26 ft bgs and was analyzed for VOCs, BNs and metals. Analytical results from the borehole water sample collected indicate that thirteen separate metals were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawings 4.46.1 and 4.46.2.

4.46.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 45. Several metals were detected in a borehole water sample above the drinking water criteria in the AOI. Downgradient from AOI 45, the metals are bounded by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 45.

4.47 AOI 46 – Department 1207 By-products

The Department 1207 By-products Area is located inside the northwest corner of Plant 12, due east of the Swarf and Shot Peening Area (AOI 45). The area consists of Department 1207 By-products Area, which was identified as SWMU 13 by the USEPA. This AOI is approximately 100 ft by 100 ft in size. AOI 46 is located indoors and has a concrete floor. The location of AOI 46 is shown on Drawing 1.2.2. Additional information on AOI 46 is presented in Section 5.46 of the DOCC.

4.47.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 46 included the advancement of two soil borings (SB-46-0601 and SB-46-0602) to investigate soil and water quality in the vicinity of AOI 46. Due to utilities in the vicinity of AOI 46, only one downgradient soil boring (SB-46-0601) was able to be installed. The location of soil boring SB-46-0601 is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-46-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.47.2 Discussion of Results

4.47.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-46-0601 was installed in AOI 46 to investigate soil and water quality. Soil samples were collected from 1 ft to 2 ft, 8 ft to 10 ft and 13 ft to 15 ft bgs from soil boring SB-46-0601. All soil samples were analyzed for VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected did not indicate constituents of concern at concentrations above soil screening criteria. Although soil boring SB-46-0602 was unable to be installed, all analytical results from SB-46-0601 were not detected above

the soil screening criteria; therefore, no additional soil investigation is warranted. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.46.1 and 4.46.2.

During Phase II of the RFI, one monitoring well was installed downgradient of AOI 46. During installation of the monitoring well, an elevated PID reading was observed in the 16 ft to 18 ft interval; therefore, a soil sample was collected from 16.5 ft to 17.5 ft bgs. The soil sample was analyzed for VOCs. Analytical results from the soil sample collected did not indicate VOCs at concentrations above soil screening criteria.

4.47.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected to investigate water quality. The borehole water sample was analyzed for VOCs, BNs and metals. Analytical results from the borehole water sample collected indicate PCE and thirteen metals were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.46.1 and 4.46.2.

During Phase II of the RFI, one monitoring well MW-0638-S2B was installed downgradient of AOI 46 to confirm results from Phase I of the RFI and determine if downgradient groundwater had been impacted by AOI 46. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected did not indicate VOC concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.1.

4.47.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 46. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 46.

4.48 AOI 47 – Spill Containment Sump

The Spill Containment Sump (former waste mineral spirits tank) is located outside of Plant 12 to the west, due south of AOI 45. This area consists of the spill containment sump and stained soil that was observed during a site investigation in 1992. AOI 47 is located outdoors and is covered with concrete, asphalt, and crushed rock. The

location of AOI 47 is shown on Drawing 1.2.2. Additional information on AOI 47 is presented in Section 5.47 of the DOCC.

4.48.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 47 included the advancement of soil boring SB-47-0601 to investigate soil and water quality in AOI 47. During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0423-S2A to characterize downgradient groundwater quality. The locations of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-47-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.48.2 Discussion of Results

4.48.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-47-0601 was installed in AOI 47 to investigate soil quality. Soil samples were collected from 1 ft to 2 ft and 8 ft to 10 ft bgs from soil boring SB-47-0601. Soil samples were analyzed for VOCs and BNs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.46.1.

4.48.2.2 Water Investigation

During Phase I of the RFI, one borehole water sample was collected from approximately 14 ft bgs from soil boring SB-47-0601 to characterize water quality in the vicinity of AOI 47. The borehole water sample was analyzed for VOCs and BNs. Analytical results from the borehole water sample collected indicate vinyl chloride was detected at a concentration above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.46.1.

During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0423-S2A to evaluate potential VOC concentrations in groundwater downgradient from AOI 47. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.1.

4.48.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 47. Although the borehole water sample contained vinyl chloride at a concentration exceeding the drinking water criteria; monitoring well MW-0423-S2A, located downgradient from AOI 47 did not indicate concentrations of VOCs exceeding groundwater screening criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 47.

4.49 AOI 50 – Henry System

The Henry System is located in the east-central portion of Plant 12. The Henry System consists of the Henry Filter System and velocity trenches, identified during the site walk performed by ARCADIS on September 9, 2004. AOI 50 is located indoors and has a concrete floor. The location of AOI 50 is shown on Drawing 1.2.2. Additional information on AOI 50 is presented in Section 5.50 of the DOCC.

4.49.1 Scope of Investigation

The scope of Phase I of the RFI at AOI 50 included the advancement of three soil borings (SB-50-0601, SB-50-0602 and SB-50-0603) and the sampling of an existing monitoring well (MW-10-S2) to evaluate soil and groundwater quality. The location of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-50-0601, SB-50-0602 and SB-50-0603 were advanced in accordance with the RFI Work Plan (November, 2005).

4.49.2 Discussion of Results

4.49.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil borings SB-50-0601, SB-50-0602 and SB-50-0603 were installed in AOI 50 to investigate soil quality. Soil samples were collected from 1 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from soil boring SB-50-0601 and from 0 ft to 2 ft, 8 ft to 10 ft and 12 ft to 14 ft bgs from soil borings SB-50-0602 and SB-50-0603. All soil samples were analyzed for BNs and metals. Analytical results from the soil samples collected did not indicate concentrations detected above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.46.1 and 4.46.2.

4.49.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from soil boring SB-50-0601 to investigate water quality in the vicinity of AOI 50. The borehole water sample was collected from approximately 18 ft bgs from soil boring SB-50-0601. The borehole water sample was analyzed for BNs and metals. Analytical results from the borehole water samples collected indicate arsenic, cadmium, lead, manganese, selenium and thallium were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.46.1 and 4.46.2.

In addition, a groundwater sample was collected from MW-10-S2 and analyzed for metals to evaluate groundwater quality in the vicinity of AOI 50. Analytical results from the groundwater sample did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.2.

4.49.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 50. Arsenic, cadmium, lead, manganese, selenium and thallium were detected in a borehole water sample at concentrations above drinking water criteria in the AOI; however, no constituents were detected above the groundwater screening criteria in downgradient monitoring well MW-10. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 50.

4.50 AOI 51 – Former Degreaser Area

Based on the risk evaluation of the pre-RFI data conducted during the preparation of the DOCC, PCE and TCE exceeded either the industrial or migration to groundwater soil criteria. 1,1-DCE, acetone, arsenic, bis(2-ethylhexyl)phthalate, cadmium, chromium (total), cis-1,2-DCE, iron, lead, manganese, methylene chloride, PCE, TCE and vinyl chloride exceeded the drinking water criteria in groundwater. The Former Degreaser Area is located in the southwest portion of Plant 12. AOI 51 consists of four areas not identified by the USEPA during the PA/VSI: four former pit mounted degreasers, one former floor mounted degreaser, one derust area, and the PCE release area. AOI 51 is located indoors and has a concrete floor. The location of AOI 51 is shown on Drawing 1.2.2. Additional information on AOI 51 is presented in

Section 5.51 of the DOCC. Note this is an industrial work place that is regulated under OSHA, as discussed in Section 1.2.3. The Soil Vapor Extraction (SVE) and limited Groundwater Recovery System installed at AOI 51 for the removal of PCE from the shallow soils and groundwater in the vicinity of the former degreaser area has been operational since October 30, 2003. A more comprehensive groundwater recovery system has been operational since September 2007. A summary of the remediation system and mass removal to date is discussed in Section 1.3.4.

4.50.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 51 included the groundwater sampling of 27 existing monitoring wells (MW-24-S2, MW-0102-S2A, MW-0108-S2B, MW-0202-S2B, MW-0202-S2A, MW-0202-S3, MW-0210-S3, MW-0402-S2B, MW-0402-S3, MW-0406-S2B, MW-0409-S2B, MW-0409-S3, MW-0414-S2A, MW-0414-S3, MW-0417-S3, MW-0418-S2A, MW-0418-S3, MW-0419-S2B, MW-0419-S3, MW-0420-S2A, MW-0420-S3, MW-0421-S2B, MW-0421-S3, MW-0423-S2A, MW-0424-S2A, MW-0425-S2B and MW-0426-S2A) to evaluate groundwater quality in the vicinity of AOI 51. After Phase I of the RFI, two monitoring wells (MW-S2-0601 and MW-S3-0601) were installed to further characterize the downgradient extent of VOC concentrations observed in groundwater and to aid with the evaluation of the interim measures associated with AOI 51. Groundwater samples were also collected from monitoring wells MW-S3-0501, MW-S2B-0501, MW-S2-0601 and MW-S3-0601 to further characterize VOC groundwater concentrations in the vicinity of the downgradient remediation system. During Phase II of the RFI, monitoring well MW-0423 was sampled to further characterize downgradient VOC concentrations (from AOI 47), located north of AOI 51. Between Phase II and Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0202-S2A, MW-0202-S2B, MW-0202-S3, MW-0406-S2B, MW-S2B-0501, MW-S3-0501 and MW-S3-0601 and recovery wells RW-0501-S2A and RW-0603-S2B. During Phase III of the RFI, eight soil borings (SB-51-0701 through SB-51-0708) were advanced to evaluate the existing concentrations of VOCs in the soil after approximately four years of operation of the SVE system. Since the soil samples collected in Phase III of the RFI were focused on previous soil sample locations and results, the historical results will be replaced by the new data in the risk assessment. Additionally during Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0201-S3. Water samples collected from the recovery wells (RW-0201-S2 through RW-0205-S2, RW-0501-S2A, RW-0501-S2B, RW-0501-S3, RW-0602-S2B, RW-0602-S3, RW-0603-S2B, RW-0604-S2B, RW-0604-S3 and/or RW-0605-S3) associated with the remediation system to evaluate performance of the system. The water samples collected from the recovery

wells are used for performance monitoring of the IM and are not intended to be used to evaluate groundwater concentrations with respect to the risk assessment but the data are discussed in Section 5.2.1. As discussed in Section 5.2.1, only groundwater data from monitoring wells are used to evaluate potential exposure. The locations of the soil borings, monitoring wells and recovery wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings and monitoring wells and recovery wells were sampled in accordance with the RFI Work Plan (November, 2005).

4.50.2 Discussion of Results

4.50.2.1 Soil Investigation

During Phase III of the RFI, soil borings (SB-51-0701 through SB-51-0708) were advanced in AOI 51 to evaluate the effectiveness of the SVE system. The location of these samples was focused on historic locations with a range of PCE concentrations. Therefore, the historical results will be replaced by the new data in the evaluation of the data. The exact replacement scheme is presented in Appendix G. Soil samples were collected from 0 ft to 2 ft, 8 ft to 10 ft, 10 ft to 12 ft and 12 ft to 14 ft bgs from soil borings SB-50-0701; from 0 ft to 2 ft, 8 ft to 10 ft and 10 ft to 12 ft bgs from soil borings SB-50-0702 and SB-50-0703; from 0 ft to 2 ft, 8 ft to 10 ft and 14 ft to 15 ft bgs from soil borings SB-50-0704 and SB-50-0707; from 0 ft to 2 ft and 8 ft to 10 ft bgs from soil borings SB-50-0706 and SB-50-0708; and from 0 ft to 2 ft, 8 ft to 10 ft, 10 ft to 12 ft and 14 ft to 15 ft bgs from soil boring SB-50-0705. Soil boring locations were located in areas with high, moderate and low concentrations of PCE in the soil to allow for evaluation of the effectiveness of the SVE system on shallow soils with a range of concentrations. Soil samples collected beneath groundwater were not considered in identifying the soil boring locations. All soil samples were analyzed for VOCs. Analytical results from the soil samples collected indicate PCE was detected at a concentration above the industrial, volatilization to indoor air and/or migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.50.1 and 4.50.2. PCE concentration contours in soil for AOI 51 are presented in Drawing 4.44.2. A comparison of the Phase III soil PCE concentrations with nearby soil concentrations collected prior to the Interim Measures installation are presented in Appendix G.

4.50.2.2 Water Investigation

During Phase I of the RFI, groundwater samples were collected from 27 existing monitoring wells (MW-24-S2, MW-0102-S2A, MW-0108-S2B, MW-0202S2B, MW-0202-S2A, MW-0202-S3, MW-0210-S3, MW-0402-S2B, MW-0402-S3, MW-0406-S2B,

MW-0409-S2B, MW-0409-S3, MW-0414-S2A, MW-0414-S3, MW-0417-S3, MW-0418-S2A, MW-0418-S3, MW-0419S2B, MW-0419-S3, MW-0420-S2A, MW-0420-S3, MW-0421-S2B, MW-0421-S3, MW-0423-S2A, MW-0424-S2A, MW-0425-S2B and MW-0426-S2A) to evaluate groundwater quality in the vicinity of AOI 51. All groundwater samples were analyzed for VOCs. Analytical results from the groundwater sample collected indicate 1,1-DCE, cis-1,2-DCE, PCE, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.50.1, 4.50.2 and 4.50.4.

Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S2) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.27.2 and 4.27.3, respectively. Concentration contours of PCE and TCE, and cis-1,2-DCE and vinyl chloride in groundwater (sand unit S3) for the eastern portion of Plant 3 and the western portion of Plant 12/14 are presented in Drawings 4.32.2 and 4.32.3, respectively.

After the Phase I of the RFI, monitoring wells MW-S2-0601 and MW-S3-0601 were installed to further characterize potential groundwater VOC concentrations in the vicinity of the downgradient remediation system. Groundwater samples were collected from monitoring wells MW-S3-0501, MW-S2B-0501, MW-S2-0601 and MW-S3-0601 and analyzed for VOCs. Analytical results from the groundwater samples indicate vinyl chloride was detected at a concentration above drinking water criteria.

During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0423-S2A and analyzed for VOCs. Analytical results from the groundwater sample collected indicate PCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.50.1, 4.50.2 and 4.50.3.

Between Phase II and Phase III of the RFI, groundwater samples were collected from monitoring wells MW-0202-S2A, MW-0202-S2B, MW-0202-S3, MW-0406-S2B, MW-S2B-0501, MW-S3-0501, MW-S3-0601, RW-0501-S2A and RW-0603-S2B. Groundwater samples were analyzed for VOCs. Analytical results from the groundwater sample collected indicate methylene chloride, PCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.50.1, 4.50.2 and 4.50.3.

During Phase III of the RFI, a groundwater sample was collected from monitoring well MW-0201-S3. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawings 4.50.1, 4.50.2 and 4.50.3. Drawing 4.50.4 presents historical analytical results for BNs and PCBs.

4.50.3 Conclusion

PCE was detected at concentrations above the industrial soil criteria, volatilization to indoor air soil criteria and/or soil migration to groundwater criteria in one or more soil borings during the RFI within AOI 51. 1,1-DCE, cis-1,2-DCE, methylene chloride, PCE, TCE and vinyl chloride were detected at concentrations above drinking water screening criteria. Within the "source area", a SVE Interim Measures remediation system was installed for the removal of PCE from the shallow unsaturated soils and a groundwater recovery system was installed downgradient from AOI 51 to prevent downgradient migration of VOCs in the groundwater. The SVE component of the Interim Measures has been operational since October 30, 2003 and is summarized (including mass removal to date) in Section 1.3.4. The downgradient groundwater extraction portion of the Interim Measures have been in operation since September 2007 . Based on the data evaluation discussed above (including the operation of the Interim Measures remediation system) and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 51.

4.51 AOI 53 – Transmission Test Assembly Area

The Transmission Test Assembly Area was located on the south-central portion of Plant 12. AOI 53 consisted of transmission test stands and a Dexron filtering and recycling unit that was not identified by the USEPA during the PA/VSI. The Transmission Test Assembly Area consisted of two transmission test stands and a transmission fluid recycling vault. Transmissions were moved through the testing area by conveyors. The transmissions were filled with fluid and drained in the area. The used transmission fluids drain into sumps, from which they are then pumped through overhead lines to the recycling unit. AOI 53 was removed from service in 2006 and the area has been retooled; however, the Dexron filtering and recycling pit and equipment is still in place. On September 12, 2001, an unknown amount of Dexron Transmission Fluid was released into a storm water drain near the test cells area and was reported to the IDEM. Section 1.3.4 details the release and Interim Measures that have been conducted at AOI 53. Prior to the RFI, a sample of Dexron Transmission Fluid was

collected from an unused drum for analysis to provide a point of reference for laboratory fingerprinting results. No concentrations above the laboratory reporting limits were identified from the sample, although the reporting limits were elevated due to the matrix of the sample. This area is located indoors and has a concrete floor. The location of AOI 53 is shown on Drawing 1.2.2. Additional information on AOI 53 is presented in Section 5.53 of the DOCC.

4.51.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 53 included the advancement of two soil borings (SB-53-0601 and SB-53-0602) to evaluate soil and water quality in the vicinity of AOI 53. Additionally, NAPL monitoring was completed within six existing monitoring wells in AOI 53 (MW-0111-S2A, MW-0203-S2A, MW-0205-S2A, MW-0206-S2A, MW-0207-S2A and MW-0208-S2A) as a part of on-going operation and maintenance tasks associated with AOI 53. During Phase II of the RFI, monitoring well MW-0203-S2A was sampled to evaluate groundwater quality in the vicinity of AOI 53. The locations of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-53-0601 and SB-53-0602 were completed in accordance with the RFI Work Plan (November, 2005).

4.51.2 Discussion of Results

4.51.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-53-0601 and SB-53-0602 were advanced in AOI 53 to characterize potential BN soil concentrations. Two soil samples were collected from soil borings SB-53-0601 and SB-53-0602 at 0 ft to 2 ft and 8 ft to 10 ft bgs. All samples were analyzed for BNs. Analytical results from the soil samples did not indicate concentrations above soil screening criteria. A summary of groundwater analytical results are presented in Table 4.1 and Drawing 4.51.1.

4.51.2.2 Water Investigation

During Phase I of the RFI, borehole water samples were collected from SB-53-0601 and SB-53-0602 at approximately 16 ft and 15 ft bgs, respectively. Borehole water samples were analyzed for BNs. Analytical results from the borehole water samples collected indicate bis(2-Ethylhexyl)phthlate was detected at a concentration above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.5 and Drawing 4.51.1.

During Phase II of the RFI, a groundwater sample was collected from monitoring well MW-0203-S2A and analyzed for BNs. Analytical results from the groundwater sample collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.51.1.

4.51.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 53. Bis(2-Ethylhexyl)phthlate was the only constituent detected in borehole water above the drinking water criteria in the AOI. Downgradient from AOI 53, bis(2-Ethylhexyl)phthlate is bounded by monitoring wells that did not have concentrations higher than the drinking water criteria prior to the RFI. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 53.

4.52 AOI 54 – Oil Stores/Waste Sump

The Oil Stores/Waste Sump is located on the east side of Plant 12 and is currently active. AOI 54 was not identified by the USEPA during the PA/VSI in 1993. AOI 54 is located indoors and has a concrete floor. The location of AOI 54 is shown on Drawing 1.2.2. Additional information on AOI 54 is presented in Section 5.54 of the DOCC.

4.52.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 54 included the advancement of soil boring SB-54-0601 and sampling of monitoring well MW-7-S2 to evaluate soil and groundwater quality in the vicinity of AOI 54. The locations of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-54-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.52.2 Discussion of Results

4.52.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-54-0601 was advanced to characterize soil quality in the vicinity of AOI 54. Two soil samples were collected from soil boring SB-54-0601 at 0 ft to 2 ft and 8 ft to 10 ft bgs and analyzed

for VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected did not indicate constituents of concern detected at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.46.1 and 4.46.2.

4.52.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from soil boring SB-54-0601 at approximately 22 ft bgs. The borehole water sample was analyzed for VOCs, BNs and metals. Analytical results from the borehole water samples collected indicate nine metals were detected at concentrations above drinking water criteria. A summary of borehole analytical results are presented in Table 4.5 and Drawing 4.46.1 and 4.46.2.

In addition, one groundwater sample was collected during Phase I of the RFI from monitoring well MW-7-S2 to evaluate groundwater quality in the vicinity of AOI 54. The groundwater sample was analyzed for VOCs and metals (total and dissolved). In accordance with the RFI Work Plan, it was proposed that a groundwater sample also be collected for BN analysis. A groundwater sample was collected for BN analysis, however, the sample container was lost during shipment to the analytical laboratory. Groundwater sample results (from the sampling of monitoring well MW-7-S2) do not, therefore, include BN results. In 2000 and 2002, prior to the RFI, samples from monitoring well MW-7-S2 were analyzed for PAHs and BNs, respectively, and no concentrations above the laboratory reporting limits were reported. Analytical results from the groundwater sample collected from monitoring well MW-7-S2 indicate manganese was detected at a concentration above the drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.1 and 4.46.2.

4.52.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 54. Although the borehole water sample contained concentrations of certain metals that exceeded the groundwater screening criteria; downgradient monitoring well MW-7-S2 was sampled to characterize the groundwater conditions. Total manganese was the only constituent detected with concentrations exceeding groundwater screening criteria and only slightly exceeded the drinking water criteria (1.8 times) and the dissolved concentration of manganese did not exhibit concentrations above the drinking water criteria. Based on the data evaluation discussed above and on the cited

tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 54.

4.53 AOI 55 – Scrap Metal Collection Hoppers

Scrap Metal Collection Hoppers are located outside of the Plant 12 building along the eastern wall. AOI 55 was not identified as an area of concern by the USEPA during the PA/VSI in 1993. AOI 55 is located outside and is paved with asphalt. The location of AOI 55 is shown on Drawing 1.2.2. Additional information on AOI 55 is presented in Section 5.55 of the DOCC.

4.53.1 Scope of Investigation

The scope of the RFI at AOI 55 involved the advancement of soil boring SB-55-0601 and sampling of monitoring well MW-10-S2 to evaluate soil and groundwater quality in the vicinity of AOI 55. The location of the soil boring and monitoring well are illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. The soil boring SB-55-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.53.2 Discussion of Results

4.53.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil boring SB-55-0601 was advanced in AOI 55 to characterize soil quality in the vicinity of AOI 54. Two soil samples were collected from soil boring SB-55-0601 at 1 ft to 2 ft and 8 ft to 10 ft bgs. Soil samples were analyzed VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected did not indicate constituents of concern detected at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.46.1 and 4.46.2.

4.53.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from soil boring SB-55-0601 at approximately 14 ft bgs and analyzed for VOCs and BNs. Analytical results from the borehole water sample collected did not indicate VOC and/or BN concentrations above groundwater screening criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.46.1.

A groundwater sample was also collected from monitoring well MW-10-S2 during Phase I of the RFI and analyzed for VOCs and BNs. Analytical results from the groundwater sample collected did not indicate VOC and/or BN concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.1.

4.53.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 55. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 55.

4.54 AOI 57 – Plant 12 Drum Staging Area

The Plant 12 Drum Staging Area is located to the east of Plant 12. The area consists of a concrete pad with secondary containment, a gasoline AST and dispensing pump, and a canopy that was not identified by the USEPA during the PA/VSI. AOI 57 is located outdoors and is paved with concrete. The location of AOI 57 is shown on Drawing 1.2.2. Additional information on AOI 57 is presented in Section 5.57 of the DOCC.

4.54.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 57 included the advancement of two soil borings (SB-57-0601 and SB-57-0602) to evaluate soil and water quality in the vicinity of AOI 57. During Phase II of the RFI, monitoring well MW-0639-S2A was installed to determine if elevated metals concentrations in groundwater samples collected during Phase I of the RFI were due to turbidity issues (i.e., potential suspended solids) observed during sampling activities. The locations of the soil borings and monitoring well are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. Soil borings SB-55-0601 and SB-55-0602 and monitoring well MW-0639-S2A were installed in accordance with the RFI Work Plan (November, 2005).

4.54.2 Discussion of Results

4.54.2.1 Soil Investigation

As proposed in the RFI Work Plan (November, 2005), soil borings SB-57-0601 and SB-57-0602 were advanced in AOI 57 to investigate soil quality in the vicinity of AOI 57. Two soil samples were collected from each soil boring from 0 ft to 2 ft and 8 ft to 10 ft bgs. Soil samples were analyzed for VOCs, BNs, PCBs, metals and cyanide. Analytical results from the soil samples collected did not indicate constituents of concern detected at concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.46.1 and 4.46.2.

4.54.2.2 Water Investigation

During Phase I of the RFI, two borehole water samples were collected from soil borings SB-57-0601 and SB-57-0602 at approximately 19 ft bgs and analyzed for VOCs, BNs, metals and cyanide. Analytical results from the borehole water samples collected indicate thirteen metals were detected at concentrations above drinking water criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.46.1 and 4.46.2.

During Phase II of the RFI, monitoring well MW-0639-S2A was installed to determine if elevated metals concentrations in groundwater samples collected during Phase I of the RFI were due to turbidity issues (i.e., potential suspended solids) observed during sampling activities. A groundwater sample was collected analyzed for metals. Analytical results from the groundwater sample collected indicate that arsenic, lead and manganese were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.2.

Monitoring well MW-0639-S2A was resampled during Phase III of RFI to confirm sample analysis results from Phase II of the RFI. A groundwater sample was collected and analyzed for metals. Analytical results from the groundwater sample collected did not indicate concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.46.2.

4.54.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 57. Although the borehole water sample contained metals concentrations exceeding the drinking water criteria; the downgradient monitoring well installed to

characterize the groundwater conditions did not contain constituents exceeding groundwater screening criteria during the last sampling event. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 57.

4.55 AOI 58 – Big Eagle Creek Outfalls

Big Eagle Creek is located to the south of the Plant 3 property and flows from west to east. The flow in the creek is highly dependent upon the amount of water being released from upstream Eagle Creek Reservoir. Two permitted stormwater outfalls from the Site (Outfall 001 (A-3-01) and Outfall 002 (A-3-02)) discharge into Big Eagle Creek, as shown on Drawing 3.3.1. AOI 58 is a creek with steep banks and wooded floodway. The location of Big Eagle Creek is shown on Drawing 1.2.2. Additional information on AOI 58 is presented in Section 5.58 of the DOCC.

4.55.1 Scope of Investigation

The scope of the RFI completed at AOI 58 included the collection of 25 sediment samples (SE-58-0601 through SE-58-0625) to evaluate if there is a discernable difference among chemical concentrations in sediments upstream of the Facility, adjacent to the Facility and downstream of the Facility. Additionally, three surface water samples were collected (WS-58-0601, WS-58-0602 and WS-58-0603) to evaluate water quality in the area of the Diesel Fuel Remediation System. The locations of the sediment and surface water samples are illustrated on Drawings 1 and 2 of the Evaluation of Creek Sediment and Surface Water Report (March 2006) (Appendix E of this report). Sediment samples and surface water samples were collected in accordance with the *RFI Work Plan - Sediment Investigation Supplement* (March, 2006).

4.55.2 Discussion of Results

4.55.2.1 Sediment Investigation

As proposed in the *RFI Work Plan - Sediment Investigation Supplement* (March, 2006), sediment samples (SE-58-0601 through SE-58-0625) were collected in AOI 58 to evaluate sediment quality in the vicinity of Big Eagle Creek (AOI 58). Eight samples were collected from each of the three reaches (upstream of, adjacent to and downstream of the Facility). In addition, one sediment sample was collected from within the retention boom associated with AOI 40. All sediment samples were

analyzed for BNs, PCBs and metals. A summary of sediment analytical results is presented in Table 4.7. An evaluation of sediment data collected at this AOI was completed and summarized in *The Evaluation of Creek Sediment and Surface Water* submitted to USEPA on October 27, 2006 (Appendix E of this report). This evaluation did not identify any evidence of impacts to creek sediments from the Facility. Additionally, the analytical limits achieved during analysis of sediment data met QAPP and validation requirements specified in the RFI Work Plan. GM and USEPA reviewed this evaluation on November 1, 2006, and USEPA was in agreement with the findings as identified in the Summary of November 1, 2006 USEPA Meeting (ARCADIS 2006d).

4.55.2.2 Water Investigation

During Phase I of the RFI, three surface water samples were collected (WS-58-0601, WS-58-0602 and WS-58-0603) to evaluate water quality in the vicinity of the retention boom associated with AOI 40. All surface water samples were analyzed for metals and BNs. A summary of surface water analytical results are presented in Table 4.8. The only chemicals detected (at concentrations above laboratory detection limits) in surface water samples from Big Eagle Creek were bis[2-chloroethyl]ether, dimethyl phthalate and manganese. There are inconsistent occurrences and low concentration of bis[2-chloroethyl]ether and dimethyl phthalate in the surface water and other media sampled during the RFI. An evaluation of sediment data collected at this AOI was completed and summarized in *The Evaluation of Creek Sediment and Surface Water* submitted to USEPA on October 27, 2006 (Appendix E of this report). This evaluation did not identify any evidence of impacts to creek sediments from the Facility. Additionally, the analytical limits achieved during analysis of surface water data met QAPP and validation requirements specified in the RFI Work Plan. GM and USEPA reviewed this evaluation on November 1, 2006, and USEPA was in agreement with the findings as identified in the Summary of November 1, 2006 USEPA Meeting (ARCADIS 2006d).

4.55.3 Conclusion

Based on the data evaluation discussed above and summarized in *The Evaluation of Creek Sediment and Surface Water* submitted to USEPA on October 27, 2006 (Appendix E of this report), there is no evidence of impacts to the creek sediments have occurred from the Facility. There are inconsistent occurrences and low concentration of bis(2-chloroethyl)ether and dimethyl phthalate in the surface water and other media sampled during the RFI; therefore, these constituents are not expected to originate from the Facility. The detection of manganese may be due to

suspended solids within the surface water sample. GM and USEPA reviewed *The Evaluation of Creek Sediment and Surface Water* on November 1, 2006 and USEPA was in agreement with the findings as identified in the Summary of November 1, 2006 USEPA Meeting (ARCADIS 2006d). Therefore, the data collected adequately characterizes sediment and surface water from within AOI 58.

4.56 AOI 59 – Little Eagle Creek

Little Eagle Creek flows north to south through a portion of Plant 12/14, just east of the Plant 12/14 building. Three stormwater outfalls from the Facility (Outfall 004 (A-12-01)) discharge into Little Eagle Creek, as shown on Drawing 3.3.1. Little Eagle Creek has steep banks with a wooded floodway. The location of Little Eagle Creek is shown on Drawing 1.2.2. Additional information on AOI 59 is presented in Section 5.59 of the DOCC.

4.56.1 Scope of Investigation

The scope of the RFI completed at AOI 59 included the collection of 24 sediment samples (SE-59-0601 through SE-59-0624) to evaluate if there is a discernable difference among chemical concentrations in sediments upstream of the Facility, adjacent to the Facility and downstream of the Facility. The locations of the sediment samples are illustrated on Drawings 1 and 2 of the *Evaluation of Creek Sediment and Surface Water* Report (October 2006) (Appendix E). Sediment samples (SE-59-0601 through SE-59-0624) were collected in accordance with the *RFI Work Plan - Sediment Investigation Supplement* (March, 2006)

4.56.2 Discussion of Results

4.56.2.1 Sediment Investigation

As proposed in the RFI Work Plan Sediment Investigation Supplement (March, 2006), sediment samples (SE-59-0601 through SE-59-0624) were collected in AOI 59 to evaluate sediment quality in the vicinity of Little Eagle Creek (AOI 59). Eight sediment samples were collected from each of the three reaches (upstream of, adjacent to, and downstream of the Facility). All sediment samples were analyzed for BNs, PCBs and metals. A summary of sediment analytical results are presented in Table 4.7. An evaluation of sediment data collected at this AOI was completed and summarized in *The Evaluation of Creek Sediment and Surface Water* submitted to USEPA on October 27, 2006 (Appendix E of this report). This evaluation did not identify any evidence of

impacts to creek sediments from the Facility. Additionally, the analytical limits achieved during analysis of sediment data met QAPP and validation requirements specified in the RFI Work Plan. GM and USEPA reviewed this evaluation on November 1, 2006, and USEPA was in agreement with the findings as identified in the Summary of November 1, 2006 USEPA Meeting (ARCADIS 2006d).

4.56.3 Conclusion

Based on the data evaluation discussed above and summarized in *The Evaluation of Creek Sediment and Surface Water* submitted to USEPA on October 27, 2006 (Appendix E of this report), there is no evidence of impacts to the creek sediments from the Facility. GM and USEPA reviewed this evaluation on November 1, 2006 and USEPA was in agreement with the findings as identified in the Summary of November 1, 2006 USEPA Meeting. Therefore, the data collected adequately characterizes sediment from within AOI 59.

4.57 AOI 60 – Hydraulic Lift Tanks

The hydraulic lift tanks were located in the engineering test garage, in the southwest corner of the Plant 3 test cells. The extent of AOI 60 includes two 375-gallon hydraulic oil above ground tanks that were not identified by the USEPA during the PA/VSI. In addition, AOI 60 includes vertical hydraulic cylinders that are located below ground surface. AOI 60 is located indoors and has a concrete floor. The location of AOI 60 is shown on Drawing 1.2.2. Additional information on AOI 60 is presented in Section 5.60 of the DOCC.

4.57.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 60 included the advancement of one soil boring (SB-60-0601) to evaluate soil and groundwater quality in the vicinity of AOI 60. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-60-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.57.2 Discussion of Results

4.57.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-60-0601 was installed to evaluate soil and groundwater quality in the vicinity of AOI 60. Two soil samples were collected from soil boring SB-60-0601 at 1 ft to 2 ft and 8 ft to 10 ft bgs and analyzed for BNs and PCBs. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.21.1.

4.57.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from SB-60-0601 at approximately 15 ft bgs to evaluate groundwater quality in the vicinity of AOI 60. The borehole water sample was analyzed for BNs. Analytical results from the borehole water sample collected did not indicate BNs at concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.5 and Drawing 4.21.1.

4.57.3 Conclusion

No constituents were detected during the RFI above the soil or groundwater screening criteria within AOI 60. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 60.

4.58 AOI 61 – Henry System

The Henry System is located in the southwest portion of Plant 6. The Henry System consists of the Henry Filter System and associated trenches, and was not identified by the USEPA during the PA/VSI. AOI 61 is located indoors and has a concrete floor. The location of AOI 61 is shown on Drawing 1.2.2. Additional information on AOI 61 is presented in Section 5.61 of the DOCC.

4.58.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 61 included the advancement of one soil boring (SB-61-0601) to evaluate soil and water quality in the vicinity of AOI 61. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is

provided in Appendix B. Soil boring SB-61-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.58.2 Discussion of Results

4.58.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-61-0601 was installed in AOI 61 to evaluate soil and water quality in the vicinity of AOI 61. Three soil samples were collected from soil borings SB-61-0601 at 1 ft to 2 ft, 8 ft to 10 ft and 14 ft to 16 ft bgs. All soil samples were analyzed for BNs and metals. Analytical results from the soil samples collected did not indicate concentrations above soil screening criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.13.1 and 4.13.2.

4.58.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected at approximately 22 ft bgs from SB-61-0601 to evaluate groundwater quality in the vicinity of AOI. The borehole water sample was analyzed for BNs and metals. Analytical results from the borehole water sample collected indicate arsenic, barium, beryllium, cadmium, chromium (total), copper, lead, manganese, nickel, thallium and vanadium were detected at concentrations above groundwater screening criteria. A summary of borehole water analytical results are presented in Table 4.5 and Drawing 4.13.1 and 4.13.2.

During Phase II of the RFI, a monitoring well MW-0633-S2 was installed to evaluate metals downgradient from AOI 33A. Groundwater samples were collected from monitoring well MW-0633-S2 during Phase II and Phase III of the RFI and analyzed for metals. Manganese (total) was detected above the drinking water criteria; however, manganese (dissolved) was not detected at concentrations above groundwater screening criteria. A summary of the analytical results is presented in Section 4.39.

4.58.3 Conclusion

No constituents were detected during the RFI above the soil screening criteria within AOI 61. Although the borehole water sample contained metals concentrations exceeding the drinking water criteria; the monitoring well installed downgradient (as discussed in Section 4.39) to characterize the groundwater conditions did not contain dissolved constituents exceeding groundwater screening criteria. Based on the data

evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 61.

4.59 AOI 62 – Process Water Release Area - North

The Process Water Release Area – North is located north of Plant 3 where below grade piping connected Plant 2 with Plant 3. The release of process water occurred in a grass covered area that is routinely mowed. Additional information on AOI 62 is presented in Section 5.62 of the DOCC.

4.59.1 Scope of Investigation

The scope of Phase I of the RFI completed at AOI 62 included the advancement of one soil boring (SB-62-0601) to evaluate soil quality in the vicinity of the release area. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-62-0601 was completed in accordance with the RFI Work Plan (November, 2005).

4.59.2 Discussion of Results

4.59.2.1 Soil Investigation

As proposed in the Phase I RFI Work Plan (November, 2005), soil boring SB-62-0601 was installed to evaluate soil quality in the vicinity of the documented release area. Two soil samples were collected from soil boring SB-62-0601 from 0 ft to 2 ft and 8 ft to 10 ft bgs. The soil samples were analyzed for VOCs, BNs, PCBs and metals. Analytical results from the soil samples collected indicate arsenic was detected at a concentration above the migration to groundwater soil criteria. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.30.1 and 4.31.1.

4.59.3 Conclusion

Arsenic was the only constituent detected above the migration to groundwater soil criteria in AOI 62. The concentration of arsenic only slightly exceeds the criteria (2.3 times). This soil boring is located near the upgradient boundry of Plant 3 and there are several monitoring wells downgradient that do not exhibit concentrations of arsenic above the groundwater screening criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil at and around AOI 62.

4.60 AOI 63 – Process Water Release Area - South

The process water release occurred in the spring of 2007 when a below grade transfer line was identified by plant personnel as leaking. The utility was excavated and repaired immediately after discovery. AOI 63 is located due east of the aboveground wastewater storage tanks (AOI 20). AOI 63 is located outdoors under asphalt. The location of AOI 63 is shown on Drawing 1.2.2. The Process Water Release Area – South was not identified at the time of the DOCC.

4.60.1 Scope of Investigation

The scope of Phase III of the RFI completed at AOI 63 included the advancement of one soil boring (SB-63-0701) south of the excavation to evaluate soil and groundwater quality after the release. The location of the soil boring is illustrated on Drawing 1.2.2 and the boring log is provided in Appendix B. Soil boring SB-63-0701 was completed in accordance with the RFI Work Plan (November, 2005). The laboratory inadvertently analyzed the soil samples from this soil boring for iron. Iron is not identified as a constituent of concern for the Facility, and specifically is not a constituent of concern for this AOI.

4.60.2 Discussion of Results

4.60.2.1 Soil Investigation

Soil boring SB-63-0701 was advanced in AOI 63 to investigate soil and groundwater quality after a release. Two soil samples were collected from soil boring SB-63-0701 at 0 ft to 2 ft and 8 ft to 10 ft bgs. All soil samples were analyzed for VOCs, BNs, PCBs, metals and cyanide. Analytical results from the soil samples collected indicate iron was detected at a concentration above migration to groundwater soil criteria. However, iron is not identified as a constituent of concern for the Facility. A summary of soil analytical results are presented in Table 4.1 and Drawings 4.30.1 and 4.31.1.

4.60.2.2 Water Investigation

During Phase I of the RFI, a borehole water sample was collected from approximately 21 ft bgs from SB-63-0701. The borehole water sample was analyzed for VOCs and BNs to evaluate water quality after the release. Analytical results from the borehole water sample collected did not indicate VOCs or BNs at concentrations above groundwater screening criteria. A summary of groundwater analytical results are presented in Table 4.5 and Drawings 4.30.1 and 4.31.1.

4.60.3 Conclusion

The laboratory inadvertently analyzed the soil samples from this soil boring for iron. Iron is not identified as a constituent of concern for the Facility, and specifically is not a constituent of concern for this AOI. Iron was the only constituent detected during the RFI above the migration to groundwater soil criteria within AOI 63 and iron is not identified as a constituent of concern for the Facility. No constituents were detected above the groundwater screening criteria in the AOI. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around AOI 63.

4.61 Plant 2 Perimeter

Plant 2 Perimeter consists of monitoring wells and/or soil borings that are located around the perimeter of the Plant 2 property. These monitoring wells may be discussed in previous sections but are summarized in this Section to provide a concise review of groundwater conditions.

4.61.1 Scope of Investigation

During Phase I of the RFI, one groundwater sample was collected from monitoring well MW2-4-S2 to verify concentrations identified prior to the RFI. During Phase II of the RFI, two monitoring wells were proposed south of Plant 2, along the south side of 10th Street, to characterize the VOCs identified in the groundwater at Plant 2. Monitoring well MW-0647 was installed to the southwest of Plant 2. Three soil borings were advanced (SB-02-06-0607, SB-02-06-0608 and SB-02-06-0609) in an attempt to install a monitoring well south of Plant 2; however, a saturated sand unit was not identified in the soil borings before a till unit was encountered. During Phase III of the RFI, five monitoring wells MW-0701-S2, MW-0702-S2, MW-0703-S2, MW-0704-S2 and MW-0705-S1 were installed. Soil boring SB-02-06-0701 was installed along the south side of 10th Street in an attempt to install monitoring well MW-0703-S2; however, a saturated sand unit was not identified before a till unit was encountered and the location of monitoring well MW-0703-S2 was located to the east of this location. The locations of the soil borings and monitoring wells are illustrated on Drawing 1.2.2 and the boring logs are provided in Appendix B. The soil borings and monitoring wells were completed in accordance with the RFI Work Plan (November, 2005).

4.61.2 Discussion of Results

4.61.2.1 Soil Investigation

One surface soil sample was collected from SB-02-06-0607 to supplement the background calculation of metal concentrations. The soil sample was analyzed for metals. Analytical results from the soil sample collected indicate arsenic at concentration above industrial soil criteria and migration to groundwater soil criteria. Therefore the results were not used for calculation of background metal concentrations. A summary of soil analytical results are presented in Table 4.1 and Drawing 4.8.1.

4.61.2.2 Water Investigation

During Phase I of the RFI, one groundwater sample was collected from monitoring well MW2-4-S2 to verify concentrations in the monitoring well prior to the RFI. The groundwater sample was analyzed for VOCs. Analytical results from the groundwater sample collected indicate concentrations of 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE and vinyl chloride above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1.

During Phase II of the RFI, monitoring well MW-0647-S2 was installed and subsequently sampled to evaluate potential VOCs concentrations in groundwater downgradient of Plant 2. Analytical results from the groundwater samples collected did not indicate concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1.

During Phase III of the RFI, monitoring wells MW-0701-S2, MW-0702-S2, MW-0703-S2, MW-0704-S2 and MW-0705-S1 were installed and sampled to characterize VOCs identified at Plant 2. The groundwater samples were analyzed for VOCs. Analytical results from the groundwater samples collected indicate that carbon tetrachloride, cis-1,2-DCE, methylene chloride, TCE and vinyl chloride were detected at concentrations above drinking water criteria. A summary of groundwater analytical results are presented in Table 4.3 and Drawing 4.6.1.

4.61.3 Conclusion

Arsenic was the only constituent detected during the RFI above the industrial soil criteria and migration to groundwater soil criteria. Therefore the results from this location were not used for calculation of background metal concentrations, as

discussed in Section 3.5. The soil boring is located under asphalt in an area of the Facility that has only been used as a parking lot. Arsenic is not a present at concentrations exceeding groundwater screening criteria in the nearest downgradient monitoring well, MW-0652-S1. The monitoring wells that are located on the northern portion of the Plant 2 property contain VOCs that exceed the drinking water criteria. No operational activities are known to have occurred in this area and thus these VOC concentrations are not believed to be site-related. However, these VOCs are bounded in the downgradient direction by monitoring wells that do not have concentrations higher than the drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes soil and groundwater at and around Plant 2. Additional investigation will be conducted to more closely bound the groundwater impacts.

4.62 Downgradient Perimeter

Downgradient Perimeter consists of monitoring wells that are located downgradient of Plant 3 or 12/14. These monitoring wells may be discussed in previous sections but are summarized in this Section to provide a concise review of downgradient groundwater conditions.

4.62.1 Scope of Investigation

The following monitoring wells were sampled during the RFI:

AOI	Monitoring Well	RFI Phase #	Analysis
AOI 1	MW-0620-S1	II	BNs and metals
AOI 1	MW-0649-S1	II	BNs and metals
AOI 2	MW-0408-S1	I and II	VOCs, BNs, metals, cyanide
AOI 9	MW-23-S2	II	Arsenic and Chromium (total)
AOI 40	MW-0106-S2A	II	VOCs and BNs
AOI 40	MW-31-S2	III	VOCs
AOI 40	MW-24-S2A	I	VOCs
AOI 51	MW-0102-S2A	I	VOCs
AOI 51	MW-0419-S2B	I	VOCs
AOI 51	MW-0419-S3	I	VOCs
AOI 51	MW-0420-S2A	I	VOCs
AOI 51	MW-0420-S3	I	VOCs
AOI 51	MW-0421-S2B	I	VOCs
AOI 51	MW-0421-S3	I	VOCs

AOI 57	MW-0639-S2A	II and III	Metals

4.62.2 Discussion of Results

4.62.2.1 Water Investigation

Groundwater samples were collected from the abovementioned monitoring wells during the RFI to characterize groundwater quality downgradient of specific AOIs as discussed in previous Sections and to generally characterize groundwater at the downgradient margin of the Facility. Arsenic (total) exceeded drinking water criteria during Phase III in monitoring well MW-0408-S1; however, the dissolved analysis did not exceed drinking water criteria. Arsenic, lead and manganese exceeded drinking water criteria in monitoring well MW-0639-S2A during Phase II of the RFI; however, when resampled during Phase III, the concentrations did not exceed drinking water criteria. No constituents were detected above the groundwater screening criteria in the other locations identified as downgraident at Plant 3 or 12/14.

4.62.3 Conclusions

Arsenic (total) exceeded drinking water criteria during Phase III in monitoring well MW-0408-S1; however, the dissolved analysis did not exceed drinking water criteria. Arsenic, lead and manganese exceeded drinking water criteria in monitoring well MW-0639-S2A during Phase II of the RFI; however, when resampled during Phase III, the concentrations did not exceed drinking water criteria. Based on the data evaluation discussed above and on the cited tables and drawings, the data collected adequately characterizes downgradient from Plant 3 and 12/14.

5 Baseline Human Health Risk Assessment

5.1 Introduction

Section 4 discussed the scope of the RFI field investigation for each of the areas investigated and compared the site characterization data collected during the RFI with conservative risk-based screening criteria to identify whether a potentially significant release of hazardous constituents to the environment may have occurred. The human health risk assessment discussed in this section evaluates the potential significance of reasonable maximum exposures to affected environmental media under current and reasonably expected future land use at and around the Facility. The methods used in the risk assessment are based on USEPA risk assessment guidance. The results of the risk assessment will be used to identify where a release of hazardous constituents from the Facility may cause reasonable maximum exposures to be significant enough to warrant interim and/or corrective measures.

The scope of the human health risk assessment is summarized in the conceptual site model (CSM) shown in Table 5.1. The CSM identifies the scenarios for potential human exposure under current and reasonably expected future conditions at and around the Facility in terms of the potentially exposed populations, the environmental media to which they could be exposed, and the potential routes of exposure. The CSM was developed based on the site information and data discussed in Sections 3 and 4, respectively. The scenarios for potential human exposure are further discussed in Section 5.3.

Discussion of the human health risk assessment is organized as follows:

- The preparation of data used in the risk assessment is discussed in Section 5.2 – Data Collection and Preparation.

- The scenarios for potential human exposure are discussed in Section 5.3 – Exposure Assessment, which also discusses the estimation of exposure concentrations and chemical intakes for each exposure scenario.

- Toxicity information for the constituents evaluated in the risk assessment is summarized in Section 5.4 – Toxicity Assessment.

- The risk estimates associated with the potential exposures discussed in Section 5.3 are quantified and their significance is discussed in Section 5.5 –

Risk Characterization. Uncertainties associated with the risk estimates are also discussed in this section.

- The findings and conclusions of the human health risk assessment are summarized in Section 5.6 – Summary and Conclusions.

5.2 Data Collection and Preparation

5.2.1 Data collection

All soil, groundwater, and NAPL data discussed in the DOCC and collected during the RFI were considered for use in the human health risk assessment, except as noted below or where specifically stated in Section 4 that the data were excluded. Sediment and surface water data collected from Big Eagle Creek and Little Eagle Creek during the RFI are not evaluated in the human health risk assessment because an evaluation of these data (included in Appendix D) determined that the Facility has not affected the sediment or surface water quality in these Creeks. Borehole water data also are not evaluated in the human health risk assessment because the data were collected primarily to support the RFI field investigation and they do not necessarily represent actual groundwater quality, as discussed in Section 4. Similarly, data for samples from groundwater remediation systems (e.g., groundwater recovery wells) are not used for the assessment of potential exposures to groundwater because they are not representative of groundwater concentrations in the saturated zones. Soil data that were collected from the vadose zone during installation of off-site monitoring wells are also not used in the risk assessment because the Facility is not believed to have affected the off-site vadose soil; these soil samples were collected to identify the presence of any vadose zone conditions that could affect interpretation of groundwater data from the monitoring wells.

The objectives of the RFI data collection and strategies for determining when additional data collection is warranted were described in the RFI Work Plan (ARCADIS 2005b) and addenda (ARCADIS 2006b, 2006c, 2007b). The scope of the RFI field investigation and a summary of the data collection activities are described in Section 2 of this report. The complete RFI data (including R-qualified data and separate results for each sample of a duplicate pair) are provided in Appendix C.

5.2.2 Data Preparation

Validation of all soil, groundwater, and NAPL data collected during the RFI was performed in accordance with the QAPP in the RFI Work Plan (ARCADIS 2005b). Summaries of the data validation results are provided in Appendix C. In addition, the following procedures were used to prepare the data in the Section 4 summary tables to support quantitative risk assessment. These procedures, which are based on USEPA guidance on human health risk assessment (USEPA 1989), are as follows:

- Constituent concentrations qualified as not detected (i.e., U or UJ-qualified data) during data validation are evaluated as non-detects.

- Constituent concentrations qualified as not usable (i.e., R-qualified data) during data validation are not included in the risk assessment.

- Concentrations qualified as estimated (i.e., J-qualified data) are included for quantitative assessment.

- Concentrations in duplicate field samples are averaged to obtain a representative concentration for the sample location. When a constituent was detected in only one sample of a duplicate pair, the average of the detected concentration and one-half the quantitation limit is used in further calculations.

- The concentrations of endosulfan, methylphenol, 1,3-dichloroproene, xylenes, and polychlorinated biphenyl (PCB) are the sums of the concentrations of the isomers or Aroclors that were detected and half the quantitation limits of the isomers or Aroclors that were not detected in the same sample but were detected in the same matrix at the Facility. If no isomer or Aroclor was detected in a sample, the constituent is considered to be not detected in the sample.

- Concentrations of metals in soil that are at or below the site-specific background levels summarized in Table 3.5.1 (and discussed in Section 3.5) are considered to be background and not site-related. Metal concentrations in soil samples that are in excess of the site-specific background levels are considered to be site-related, and are used in the calculation of site-related risks.

- As a conservative assumption, all concentrations of organic constituents detected in on-site matrices are assumed to be site-related.

- Data for soil samples from AOI 51 that are in close proximity to more recent soil samples that were collected to evaluate the effectiveness of ongoing soil remediation at AOI 51 are replaced by the data from the more recent samples. Appendix G provides a summary of which of the older soil samples were replaced by which of the more-recent soil samples.

No constituent that was detected in soil, groundwater, or NAPL is excluded from the risk assessment, except as noted above.

5.3 Exposure Assessment

This section discusses the potential exposures that are relevant under current and reasonably expected future land use at and around the Facility. The exposure setting, potentially exposed populations, and exposure pathways are discussed below in Sections 5.3.1 to 5.3.3.

For potential exposures via ingestion and dermal contact, as discussed in this section, exposure is quantified in terms of a dose, as follows:

$$Dose = Concentration \cdot Intake$$

The dose for evaluating cancer risk is averaged over a lifetime and is called the lifetime average daily dose (LADD). For evaluating long-term (or chronic) and shorter-term (subchronic) noncancer effects, the dose is averaged over the duration of potential exposure and is called the average daily dose (ADD). The concentration term in the dose equation refers to the average chemical concentration in an environmental medium to which a population is exposed over a specified duration. The intake term refers to the intake rate of the contaminated environmental medium, which is a function of the magnitude, frequency, and duration of exposure. The methods for estimating the concentration term are discussed in Section 5.3.4. The exposure factors that are used to quantify the magnitude, frequency, and duration of potential exposures are discussed in Section 5.3.5.

Potential exposures via inhalation are quantified as an average daily concentration in air. The exposure concentration for evaluating cancer risk is averaged over a lifetime.

For evaluating chronic and subchronic noncancer effects, the exposure concentration is averaged over the period of exposure. The methods for estimating the concentration term are discussed in Section 5.3.4.

5.3.1 Exposure Setting

The environmental setting at and around the Facility, including climate, geology, hydrogeology, land cover, surface water bodies, water supply, and groundwater use, is discussed in Section 3, and therefore, is not repeated in this sub-section.

5.3.2 Potentially Exposed Populations

As discussed in Sections 1.2 and 3.1, the Facility occupies approximately 220 acres on three parcels that are zoned for light and heavy industry in the Town of Speedway and the City of Indianapolis, Indiana. Future land use on all three parcels is expected to remain commercial/industrial, because GM sold the three parcels to the current owner under the condition that land use remains commercial/industrial and that this restriction be recorded in the deed. As such, workers comprise the main receptor population at the Facility under both current and reasonably expected future land use.

Manufacturing at Plant 2 ceased in the mid-1990s and the buildings were demolished in 2004. Partial concrete floor slabs cover some of former Plant 2, and the areas not covered by slabs are covered by either asphalt or gravel. Under current conditions, the only populations with potentially significant exposures at Plant 2 are routine workers who drive trucks around the parking lot to test transmissions trespassers. Public access to Plant 2 is limited by fencing and warning signs, and as such, even trespasser exposure is unlikely. Redevelopment of Plant 2 for commercial/industrial reuse is possible as part of a revitalization project, discussed in Section 3.7.3. Therefore, potential receptors in the future could include construction workers involved with site redevelopment, routine workers during post-redevelopment use of the site, and maintenance workers conducting occasional post-redevelopment construction or maintenance (e.g., during installation or repair of underground utilities, or during removal or repair of pavement).

Plants 3 and 12/14 consist primarily of active manufacturing operations. These Plants also include paved parking lots and grassy areas. The area west of Plant 3 has two baseball fields which are located within a part of AOI 2 and a partially wooded transmission test track which is located within a part of AOI 1. Under current conditions, the populations with potentially significant exposures at Plants 3 and 12/14

are routine workers, maintenance workers, and trespassers. At AOI 2, potential exposure of recreational visitors using the baseball fields is also possible. There is no plan to change these parts of Plants 3 and 12/14. However, it is possible that a strip of land along the southern boundary of Plant 3 and extending beyond the Facility (paralleling Big Eagle Creek) could be converted into a nature walk as part of a revitalization project, discussed in Section 3.7.3.

The off-site areas within approximately a half-mile of the Facility consist of a mix of commercial/industrial and residential land use. Current zoning for these areas is expected to remain unchanged, as discussed in Section 3.7. As such, the largest potentially exposed populations around the Facility are residents and workers. Additionally, it is possible for recreational visitors to contact sediment, surface water, and the NAPL sheen (within the boomed area at AOI 40) in Big Eagle Creek during recreational activities. However, as discussed in Section 6.2, the sediment and surface water data collected from the Creek show that the Facility has not affected the Creek.

In summary, the potentially exposed populations at and around the Facility under current and reasonably expected future land use include the following:

On-Site:
- Routine workers
- Maintenance workers
- Trespassers
- Construction workers
- Recreational visitors

Off-Site:
- Residents
- Routine workers
- Maintenance workers
- Recreational visitors

5.3.3 Exposure Pathways

The exposure pathways evaluated in the risk assessment are summarized in the conceptual site model shown in Table 5.1. Exposure pathways for on-site receptors are discussed in Section 5.3.3.1, and exposure pathways for off-site receptors are discussed in Section 5.3.3.2.

5.3.3.1 Potential On-Site Exposure

Current on-site receptors evaluated in the risk assessment include routine workers, maintenance workers, trespassers, and recreational visitors (at the baseball fields in AOI 2). Future on-site receptors evaluated in the risk assessment include construction workers involved with site redevelopment at Plant 2 and recreational visitors at the southern portion of Plant 3 along Big Eagle Creek if this area becomes a nature walk. The types of potential exposures evaluated for each receptor are discussed below.

Routine Workers

The largest receptor population at the Facility consists of workers who are engaged in routine manufacturing. Routine workers are engaged in commercial and/or industrial activities that generally take place indoors. During limited time outdoors, workers could contact soil in unpaved areas. Potential routes of exposure to surface soil would include incidental ingestion, dermal contact, and inhalation of soil vapor and airborne particulates.

These workers also could be exposed to constituents in the subsurface from soil, groundwater in the S1 or S2 units, and NAPL if the constituents were to volatilize and migrate through cracks in the building foundation into indoor air.

Exposure of routine workers via potable groundwater use is not evaluated because groundwater is not used as a potable water supply at the Facility (or downgradient of the Facility), and a deed restriction for the Facility precludes future potable groundwater use, as discussed in Section 1.2.2. Exposure of routine workers to groundwater via non-potable (non-contact cooling) uses is possible at certain areas of the Facility. However, no non-potable water supplies are known to exist in the vicinity of the Facility.

Maintenance Workers

Currently, workers who are involved with occasional maintenance or construction activities at the Facility follow health and safety procedures to prevent significant exposure. However, the risk assessment evaluates potential exposures under a hypothetical future scenario in which maintenance workers do not necessarily follow health and safety procedures or wear personal protective equipment. As such, workers conducting occasional subsurface maintenance or construction activities under this hypothetical scenario could contact surface and subsurface soil in paved and unpaved areas of the Facility. These subsurface activities are

expected to be of limited size and duration (e.g., installation or repair of underground utilities, or removal or repair of pavement). Potential routes of exposure to surface and subsurface soil would include incidental ingestion, dermal contact, and inhalation of soil vapor and airborne particulates.

Maintenance workers are not expected to encounter groundwater during excavations at most of the Facility, since groundwater is generally found at 12 ft bgs or deeper at and around the Facility and utility lines are typically no more than 10 ft bgs at and around the Facility. However, to streamline the risk assessment, maintenance worker contact with groundwater is evaluated at all AOIs to avoid the need to distinguish precisely where such exposures are likely or unlikely. Potential routes of exposure would include incidental ingestion, dermal contact, and inhalation of vapor.

Similarly, potential exposure of maintenance workers to subsurface NAPL, which is present at AOIs 19, 30, and 40, is evaluated to streamline the risk assessment even though such exposure is unlikely because the NAPLs at these AOIs are generally deeper than the expected maximum depth of excavations for maintenance of underground utilities in these areas. The risk assessment evaluates the most potentially significant routes of exposure to NAPL which are expected to be dermal contact and inhalation of vapor.

Trespassers

Potential exposure of trespassers is possible, although fencing and security personnel control access to the Facility. These controls make trespassing unlikely, and would limit the duration of any unauthorized access as well as the types of activities while on-site. While on-site, trespassers could come into contact with soil in unpaved areas. Potential routes of exposure would include incidental ingestion, dermal contact, and inhalation of soil vapor and airborne particulates.

Trespasser exposures to soil in this risk assessment are evaluated indirectly using exposure estimates for routine workers. This streamlines the risk assessment and is conservative because trespasser exposures to soil would be lower than routine worker exposures to soil (ENVIRON 2003).

Construction Workers

Workers conducting construction activities during future site redevelopment at Plant 2 could be exposed to soil. Groundwater is typically found 12 ft or deeper below ground surface (bgs) at and around the Facility and future utility lines are not expected to extend deeper than 10 ft bgs. Potential routes of exposure to these media for construction workers are the same as those for maintenance workers, which are discussed above.

Recreational Visitors

Potential exposure of recreational visitors who use the baseball fields at AOI 2 is possible. Additionally, potential exposure of recreational visitors is also possible at the southern portion of Plant 3 if this area and adjoining off-site areas along Big Eagle Creek are developed as a nature walk. These recreational visitors could come into contact with on-site soil in unpaved areas at the southern portion of Plant 3. Potential routes of exposure to constituents in soil are incidental ingestion, dermal contact, and inhalation of soil vapor and airborne particulates.

These recreational exposures to soil are conservatively evaluated in this risk assessment using exposure estimates for routine workers. This streamlines the risk assessment and is conservative because the types of recreational exposures to soil at AOI 2 and the southern part of Plant 3 are expected to be lower than routine worker exposures to soil.

5.3.3.2 Potential Off-Site Exposure

Off-site receptors include residents, routine workers, maintenance workers, and recreational visitors. The types of potential exposures for each receptor are discussed below.

Residents

Off-site residents could be exposed to constituents in groundwater underneath off-site buildings if the constituents volatilize and migrate through cracks in building foundations. These potential exposures are conservatively evaluated in this risk assessment by estimating cumulative cancer risk and HI using maximum concentrations in groundwater at the AOIs that are located at the downgradient boundary of the Facility.

Exposure of residents via potable and nonpotable groundwater uses is not expected because groundwater is not a current or reasonably expected future water supply downgradient of the Facility, as discussed in Section 3.6.

Currently, no NAPL extends beneath off-site buildings; therefore current exposure of off-site residents is not possible. Off-site residents could be exposed to constituents in NAPL in the future if NAPL migrates under off-site buildings and the constituents volatilize and migrate through cracks in building foundations. Potential exposures are evaluated in this risk assessment by estimating cumulative cancer risk and HI using maximum concentrations in NAPL at the AOIs where NAPL was identified.

Routine Workers

Off-site workers could be exposed to constituents in groundwater underneath off-site buildings if the constituents volatilize and migrate through cracks in building foundations. These potential exposures are conservatively evaluated in this risk assessment by estimating cumulative cancer risk and HI using maximum concentrations in groundwater at the AOIs that are located at the downgradient boundary of the Facility.

Exposure of routine workers via groundwater use is not expected because groundwater is not a current or reasonably expected future water supply in the vicinity of the Facility, as discussed in Section 3.6.

Currently, no NAPL extends near any off-site buildings; therefore current exposure of off-site routine workers is not possible. Off-site workers could be exposed to constituents in NAPL in the future if NAPL migrates under off-site buildings and the constituents volatilize and migrate through cracks in building foundations. Potential exposures are evaluated in this risk assessment by estimating cumulative cancer risk and HI using maximum concentrations in NAPL at the AOIs that are located near the downgradient boundary of the Facility.

Maintenance Workers

Workers performing maintenance of existing underground utilities that extend to groundwater (along Grande Ave.) could be exposed to constituents in groundwater in the S1 or S2 units. Potential routes of exposure would include incidental ingestion, dermal contact, and inhalation of vapor. These potential

exposures are evaluated in this risk assessment by using exposure estimates for on-site maintenance workers. This streamlines the risk assessment and is conservative because on-site exposures are expected to be higher than that for off-site maintenance workers due to higher exposure concentrations on-site as compared to exposure concentrations off-site.

Workers performing maintenance at off-site outfalls could be potentially exposed to sediment and surface water in either Big Eagle Creek or Little Eagle Creek. However, as discussed in Section 6.2, the sediment and surface water data collected from the Creeks show that the Facility has not affected the Creeks.

Recreational Visitors

Recreational visitors could be exposed to constituents in groundwater and NAPL that discharge to surface water in Big Eagle Creek. Potential routes of exposure include incidental ingestion, dermal contact, and inhalation of vapor during recreational activities. Potential routes of exposure for NAPL would include dermal contact and inhalation of vapor during recreational activities in the immediate vicinity of the boomed area at AOI 40. Recreational visitors also could be exposed via various exposure pathways to constituents in groundwater that discharges to Big Eagle Creek.

Off-site receptors also could be exposed to constituents in soil at the Facility via windblown dust. In this risk assessment, potential airborne exposures of off-site receptors are conservatively evaluated using exposure estimates for on-site workers. This approach streamlines the risk assessment and is conservative because airborne exposures off-site are expected to be lower than exposure on-site due to much greater air dispersion between an on-site emission source and off-site receptors as compared to air dispersion directly over an emission source (ENVIRON 2003).

5.3.4 Selection of Exposure Concentrations

Soil

Reasonable maximum exposures (RME) are conservatively estimated in this risk assessment by first using the maximum detected concentrations at any depth in each area to calculate upper-bound estimates of cumulative cancer and noncancer risks for each area. If these upper-bound estimates of RME risks do not exceed USEPA's cumulative cancer and noncancer risk triggers for corrective measures (i.e., cumulative

site-related cancer risk of 10^{-4} and noncancer hazard index (HI) of 1), then further calculations are not necessary. If an upper-bound estimate for an area exceeds a trigger for corrective measures, then a RME estimate is calculated by appropriately replacing the maximum concentrations for the constituents that contributed most to the upper-bound estimates with concentrations that better represent the exposure concentrations for RME estimation. Where such refinements were made, the actual refinement for each case and rationale are discussed in Section 5.5.2. This approach is efficient in that it avoids calculations (such as 95% upper confidence limit calculations) that would not materially affect cumulative cancer and noncancer risk estimates, and is consistent with USEPA guidance (1989).

In cases where a refined exposure concentration is estimated as a 95% upper confidence limit (UCL) on the mean concentration, the 95% UCL is calculated using a nonparametric bootstrap method known as the BCa (bias-corrected and accelerated) method (Efron and Tibshirani 1998) with 4,000 bootstrap replications to ensure adequate accuracy. Like all nonparametric methods, this nonparametric bootstrap method does not require identification of a probability distribution for the data and are reliable for a wide range of distributions including normal and lognormal data (USEPA 1997c). Current USEPA guidance now recommends the use of nonparametric methods (including nonparametric bootstrap methods) in favor of methods recommended in older guidance (USEPA 1992c), especially for situations where the probability distribution of a data set is not normal or is difficult to identify.

The use of maximum concentrations, rather than 95% UCLs, for many constituents in this risk assessment introduces more conservatism than necessary for RME estimates because it assumes constant simultaneous worst-case exposure to many constituents, when the RME generally would not have so many constituents at worst-case concentrations at all times. The uncertainties associated with the use of such conservative estimates of exposure concentrations in evaluating the significance of potential exposures is discussed in Section 5.5.3.

Groundwater

To assess potential exposures to groundwater under current and future conditions at each AOI, the highest detected concentration for each constituent among the monitoring wells screened in the S1 or S2 saturated units (the uppermost saturated units) for each AOI are initially used in the risk assessment to streamline risk calculations. Where this approach results in the identification of a potentially significant exposure, the representativeness of the highest detected concentration is evaluated

and discussed in Section 5.5.2. Groundwater data from deeper saturated zones are not quantitatively evaluated in the risk assessment because there is no complete exposure pathway to groundwater in these deeper saturated units. These saturated units are much deeper than the depth to which workers are expected to excavate at and around the Facility (about 10 feet), and are not relevant to vapor intrusion because they are overlain by shallower saturated units, which prevent vapor emission from the deeper saturated units to the vadose zone. Also, groundwater in these units are not a current or reasonably expected future water supply at and downgradient of the Facility, as discussed in Section 3.6.

However, as discussed above, the use of maximum concentrations introduces more conservatism than necessary for RME estimates. In addition, the maximum concentrations in unfiltered and filtered water samples (when both were analyzed) are conservatively used to evaluate all exposure routes even though filtered concentrations are more appropriate for calculating risks for the dermal and inhalation exposure routes. The uncertainties associated with the use of such conservative estimates of exposure concentrations in evaluating the significance of potential exposures is discussed in Section 5.5.3.

NAPL

To assess potential exposures to NAPL, the maximum concentrations among the samples collected in each AOI were used for all detected constituents. These NAPL characterization data are summarized in Table 4.6.

5.3.5 Fate and Transport Models

The following models are used in the baseline risk assessment to estimate exposure concentrations for the exposure scenarios discussed in Section 5.3.3. These models are used by USEPA and state regulatory agencies for screening-level analysis. The following are brief descriptions of the models. Further details of these models are provided in Appendix E.

Vapor Intrusion into Buildings

Indoor air concentrations resulting from migration of vapors from soil, groundwater, or NAPL into a building are estimated using the model described by Johnson and Ettinger (1991), which USEPA recommends for screening-level evaluations (USEPA 2004a). The calculations in this risk assessment use

default building characteristics recommended by MDEQ (1998) and generic soil properties recommended by USEPA (2004a) that are representative of the soil types at the Facility. The MDEQ building characteristics are considered conservative for the evaluation of current conditions because the buildings currently at the Facility are much larger in size than the commercial building assumed in the MDEQ guidance. These assumptions are used because neither IDEM nor USEPA vapor intrusion guidance provide default assumptions for commercial/industrial building characteristics. A discussion of the model and the input parameters used in the assessment is provided in Appendix E.

Vapor Emission from Exposed Water

The model for estimating vapor emissions from exposed water surfaces in excavations is based on mass-transfer coefficients recommended in USEPA guidance (USEPA 1995a). A discussion of the model and the input parameters used in the calculation is provided in Appendix E.

Vapor Emission from Exposed Soil

Vapor emissions from exposed soil are estimated using the Jury model (Jury et al. 1983), based on depletion over time of soil initially contaminated from the surface to an infinite depth. A discussion of the model, adapted by USEPA for screening-level calculations (USEPA 1996a), is provided in Appendix E.

Vapor Emission from NAPL

Vapor emissions from exposed NAPL in above ground piping are estimated using Raoult's Law and mass transfer coefficients from the "oil film surface emission model" (USEPA 1987). A discussion of the model and the input parameters used in the calculation is provided in Appendix E.

Air Dispersion

Air concentrations are estimated using the empirical correlations presented in USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA 2002), assuming a square source area, and correlation coefficients for the Chicago, Illinois meteorological area. The source area for each receptor is as follows: maintenance workers are based on a 15 foot by 15 foot excavation, routine workers, construction workers, and recreational visitors are conservatively based on 16 acres (which is the approximate area of the

largest AOI and the approximate area of Plant 2 where site redevelopment could occur).

For the maintenance worker scenarios, the maximum 1-hour air concentrations are converted to maximum 24-hour average air concentrations using a conservative factor of 0.4 (USEPA 1995b). For the routine worker, redevelopment worker, and resident scenarios, the maximum 1-hour air concentrations are converted to maximum annual average air concentrations using a conservative factor of 0.08 (USEPA 1995a). The air concentrations estimated in this approach are conservative (i.e., expected to predict higher concentrations than the actual air concentrations to which receptors would be exposed).

Dust Emission

Emission of respirable soil particulates (PM_{10}) for routine worker and resident exposures to outdoor soil are calculated using the wind-erosion model recommended by USEPA (1996) with USEPA-default soil parameters and site-specific wind speed (NOAA 2004).

Emission and dispersion modeling were not used to estimate airborne dust concentrations for maintenance and construction activities, because such activities are required to ensure that dust levels do not exceed air standards for dust. Specifically, it is expected that dust concentrations will comply with the National Ambient Air Quality Standards (NAAQS). The annual average NAAQS for PM_{10} (50 ug/m^3) is used in the assessment of redevelopment construction worker exposures, and the 24-hour average NAAQS for PM_{10} (150 ug/m^3) is used in the assessment of maintenance/utility worker exposures. It was conservatively assumed that the PM_{10} concentration would be at these limits every day for the entire assumed periods of exposure.

Uncertainties inherent in the models and the conservative assumptions that are used in this risk assessment to address such uncertainties (particularly the estimation of exposure concentrations) are discussed in Section 5.5.3.

5.3.6 Estimation of Intakes

The exposure factors for evaluating the exposure scenarios summarized in the CSM and discussed in Section 5.3.3 are discussed in this section. In this risk assessment,

standard default exposure factors recommended by USEPA for estimating RME are used where available and appropriate. Where standard default exposure factors are not available or not appropriate for an exposure scenario, the evaluation is conducted using similarly conservative exposure factors that are based on site-specific considerations and professional judgment.

5.3.6.1 Routine Workers

In this risk assessment, potential exposure of routine workers to soil is conservatively evaluated using the standard default exposure factors that USEPA (1991a) recommends for estimating RME. According to USEPA, the standard default exposure factors are conservative assumptions about the magnitude, frequency, and duration of exposures, which, in combination, are intended to provide estimates of exposures that are higher than actual exposures to a large portion (90% to 99%) of a potentially exposed population.

Soil Ingestion Rate

A soil ingestion rate of 50 mg/day is used for routine workers. USEPA has recommended the use of this value for evaluating high-end routine worker exposures to soil (USEPA 1991a).

Soil Dermal Contact Rate and Absorption

The dermal contact rate is the product of the exposed skin surface area and the soil-to-skin adherence factor. The exposed skin area of 3,300 cm^2 and the soil-to-skin adherence factor of 0.2 mg/cm^2 are the USEPA-recommended skin area and adherence factor for evaluating high-end contact with soil by workers in industrial settings (USEPA 2004b). The absorbed dose from dermal contact with soil is estimated by multiplying the dermal contact rate by USEPA-recommended absorption factors for absorption from soil (USEPA 2004b).

Exposure Frequency and Duration

Routine workers are assumed to be at the Facility for 250 days per year for 25 years. This combination of exposure frequency and exposure duration is expected to be conservative for the amount of time that workers are actually in contact with soil, as routine workers spend the majority of their time indoors. USEPA has recommended the use of these values for evaluating high-end routine worker exposures (USEPA 1991a).

Body Weight

The body weight of 70 kg is the standard USEPA-recommended body weight for assessing exposure to adults (USEPA 1989).

Averaging Time

The averaging time for evaluating cancer risk is equal to a lifetime of 70 years, and the averaging time for evaluating noncancer risk is equal to the exposure duration (USEPA 1989).

Although it is recognized that the use of the default exposure factors, rather than site-specific factors (e.g., a fraction contact term < 1), results in overestimation of RME risks at the Facility, this approach streamlines the risk assessment. The assessment is also streamlined because the added conservatism in these risk estimates allows them to be used as conservative estimates for other receptors (e.g., trespassers). In this risk assessment, the risk estimates for routine workers are used to evaluate potential exposures of trespassers to soil because the exposure to these receptors are expected to be lower than those evaluated (ENVIRON 2003).

5.3.6.2 Maintenance Workers

The exposure factors used for evaluating potential exposure of maintenance workers to soil, groundwater, and NAPL are as follows:

Soil Ingestion Rate

A soil ingestion rate of 200 mg/day is used for workers performing maintenance work that involves excavation into the soil. This rate is lower than the 480 mg/day that is often cited as USEPA's recommended soil ingestion rate for excavation or construction scenarios (USEPA 1991a). However, the 480 mg/day rate is based on an assumption regarding soil adherence to hands that has been shown in USEPA-funded field studies to overestimate (by 3 to 4-fold) soil adherence to hands during various excavation and construction activities. Replacing the earlier soil adherence assumption with soil adherence data from the USEPA-funded studies (USEPA 1997b) would give a soil ingestion rate of approximately 120 mg/kg to 160 mg/kg. Therefore, using a rate of 200 mg/kg is conservative.

Soil Dermal Contact Rate and Absorption

The dermal contact rate is the product of the exposed skin surface area and the soil-to-skin adherence factor. The exposed skin area of 3,300 cm^2 and the soil-to-skin adherence factor of 0.2 mg/cm^2 are the USEPA-recommended skin area and adherence factor for evaluating high-end contact with soil by workers in industrial settings (USEPA 2004b). The absorbed dose from dermal contact with soil is estimated by multiplying the dermal contact rate by USEPA-recommended absorption factors for absorption from soil (USEPA 2004b).

Groundwater Ingestion Rate

A rate of 0.005 L/hour is used for incidental ingestion of groundwater during construction work in excavations that extend into groundwater. This rate is 10% of the rate that USEPA (1989) recommends for ingestion while swimming, and represents a very conservative estimate of incidental groundwater ingestion that could occur while workers are in an excavation pit.

Groundwater and NAPL Dermal Contact Rates

The exposed skin surface area of 3,300 cm^2 is based on the USEPA-recommended exposed skin surface area for evaluating high-end contact with soil by workers in industrial settings (USEPA 2004b). Workers are conservatively assumed to be covered with groundwater or NAPL over this exposed skin surface area for 2 hours per event. The absorbed dose for organic chemicals is estimated using a nonsteady-state approach (USEPA 2004b), which is more conservative than the steady-state approach (USEPA 1989), particularly for hydrophobic chemicals. The permeability coefficient (K_p) for dermal absorption from groundwater and NAPL are estimated following USEPA guidance (1992a, 2004b).

Exposure Frequency and Duration

The number of days of construction that involves actual excavation into soil, groundwater, or NAPL is assumed to be 50 days, which is assumed to occur at a frequency of 5 days/year for a period of 10 years. This combination of exposure frequency and exposure duration is expected to be conservative for the amount of time that workers are actually in contact with soil, groundwater, or NAPL (as opposed to the total time for maintenance or construction, which typically includes time not associated with excavation). The assumption of 5 days/year can represent the excavation time for a few small repairs per year or one larger

repair. The duration of 10 years is longer than the length of time that workers typically work at one location (USEPA 1997b).

Body Weight

The body weight of 70 kg is the standard USEPA-recommended body weight for assessing exposure to adults (USEPA 1989).

Averaging Time

The averaging time for evaluating cancer risk is equal to a lifetime of 70 years, and the averaging time for evaluating noncancer risk is equal to the exposure duration (USEPA 1989).

5.3.6.3 Construction Workers

The exposure factors used for evaluating potential exposure of construction workers to soil during excavations associated with site redevelopment activities are the same as those for maintenance workers discussed in Section 5.3.6.2, except as follows:

Exposure Frequency and Duration

Construction workers are assumed to contact soil for up to 250 days for 1 year. This combination of exposure frequency and exposure duration is expected to be conservative for the amount of time workers are actually in contact with soil at any one location, as discussed in Appendix E.

5.3.6.4 Trespassers

Potential exposure of trespassers to soil is evaluated using the risk estimates for routine workers, based on the exposure factors discussed in Section 5.3.6.1.

5.3.6.5 Recreational Visitors

Potential exposure of recreational visitors to soil is evaluated using the risk estimates for routine workers, based on the exposure factors discussed in Section 5.3.6.1.

Potential exposure of recreational users via contact with surface water during recreational activities in Big Eagle Creek is evaluated by comparing estimated concentrations in surface water with state and federal surface water quality criteria.

Uncertainties associated with the exposure factors used in estimating chemical intakes are discussed in Section 5.5.3.

5.4 Toxicity Assessment

A toxicity assessment identifies potential adverse health effects that are associated with exposure to chemicals, and determines the dose-response relationship between exposure and the occurrence of adverse effects. The toxicity values used in this risk assessment were compiled from USEPA's hierarchy of sources, as follows:

1. Integrated Risk Information System (IRIS);
2. Provisional Peer Reviewed Toxicity Values (PPRTV); and
3. Other Toxicity Values (e.g., historical HEAST and NCEA provisional values).

When a toxicity value was not available from the first two tiers of the hierarchy, other USEPA and non-USEPA sources (e.g., ATSDR) of toxicity values were consulted. The toxicity values used in the risk assessment and their sources are summarized in Appendix E and are discussed below.

5.4.1 Cancer Toxicity Values

USEPA considers chemicals belonging to the following USEPA cancer weight-of-evidence groups as human carcinogens:

Group A	Known Human Carcinogen: Sufficient evidence of carcinogenicity in humans
Group B1	Probable Human Carcinogen: Limited evidence of carcinogenicity in humans
Group B2	Probable Human Carcinogen: Sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans
Group C	Possible Human Carcinogen: Limited evidence of carcinogenicity in animals and inadequate or lack of evidence in humans

As shown in Appendix E, USEPA has designated some of the constituents as Group B2 or Group C, which means that USEPA acknowledges that there is either inadequate evidence or a lack of evidence that these constituents actually cause

cancer in humans. Therefore, evaluating these constituents as human carcinogens in the risk assessment is conservative.

USEPA-derived cancer slope factors (SFs) and inhalation unit risk factors (URFs) for these constituents and their sources are shown in Appendix E. The oral SFs and URFs represent 95% upper confidence bounds on the probability of getting cancer over a lifetime per unit dose. As recognized by USEPA, there is significant scientific evidence that some of the SFs and URFs may be overly conservative and may ignore the potential existence of threshold doses. Nonetheless, they are used here as conservative assessment tools.

5.4.2 Noncancer Toxicity Values

USEPA-derived chronic reference doses (RfDs) and chronic inhalation reference concentrations (RfCs) and their sources are shown in Appendix E. Subchronic RfDs and RfCs are also used in the risk assessment for evaluating the subchronic exposures associated with the construction worker scenario. These values and their sources are included in Appendix E.

The oral RfDs and inhalation RfCs represent conservative estimates of the daily exposure to the human population, including sensitive subpopulations (e.g., children), which are likely to be without an appreciable risk of deleterious effects during a lifetime. These RfDs and RfCs typically incorporate several safety factors to account for uncertainties in their derivation, which in combination often result in overall uncertainty factors of 1,000 or more. Furthermore, for many constituents, there is significant scientific debate about the validity of these RfDs and RfCs, and the association of these doses and concentrations to potential adverse health consequences. Nonetheless, the RfDs and RfCs are used here as conservative assessment tools.

5.4.3 Extrapolation of Toxicity Values

The USEPA sources of toxicity values listed above do not provide dermal toxicity values for any of the constituents. Therefore, oral toxicity values (i.e., oral SFs and RfDs) are used as dermal toxicity values in this risk assessment. Adjustments to the oral toxicity values, where appropriate, are made in this route-to-route extrapolation following USEPA guidance (USEPA 2004b).

The USEPA sources of toxicity values listed above do not provide inhalation toxicity values (URFs and RfCs) for all of the constituents. For a constituent that has no

inhalation toxicity values, the oral SF and/or RfD, if available, is converted to an URF and/or RfC using default USEPA assumptions (USEPA 1997a).

Uncertainties introduced by using extrapolated toxicity values are discussed in Section 5.5.3.

5.4.4 Occupational Inhalation Limits

Since the Facility is regulated by OSHA, the risk assessment includes an evaluation of current worker inhalation exposures based on occupational inhalation limits from the following hierarchy: permissible exposure limits (PELs) established by OSHA (29 CFR 1910), threshold limit values (TLVs) recommended by the American Conference of Government Industrial Hygienists (ACGIH, 2005), and the recommended exposure limits (RELs) established by National Institute for Occupational Safety and Health (NIOSH). These inhalation limits for constituents evaluated in the risk assessment are shown in Appendix E.

5.5 Risk Characterization

The health significance of the potential exposures identified in Section 5.3 is discussed in the following subsections. Section 5.5.1 describes the methods for quantifying cancer risks and noncancer hazard indices. Section 5.5.2 discusses the risk estimates and the significance of the potential exposures. Uncertainties in the risk evaluation are discussed in Section 5.5.3.

5.5.1 Cancer Risk and Noncancer Hazard Index

The cancer risk associated with potential exposure to a carcinogenic chemical via ingestion and dermal contact is calculated by multiplying an estimate of the lifetime average daily dose (LADD) for a particular exposure scenario by the cancer slope factor (SF) for the chemical, as follows:

$$Risk = LADD \cdot SF$$

For the inhalation route, the cancer risk is calculated using the chemical concentration in air (C_{air}) and the URF, as follows:

$$Risk = C_{air} \cdot URF \cdot \frac{EF \cdot ED}{AT}$$

where EF is exposure frequency, ED is exposure duration, and AT is averaging time.

The noncancer hazard quotient (HQ) associated with potential exposure via ingestion and dermal contact to a chemical being evaluated for potential noncarcinogenic health effects is calculated by dividing an estimate of the average daily dose (ADD) for a particular exposure scenario by the reference dose (RfD) for the chemical, as follows:

$$HQ = \frac{ADD}{RfD}$$

For the inhalation route, the HQ is calculated using C_{air} and the RfC, as follows:

$$HQ = \frac{C_{air}}{RfC} \cdot \frac{EF \cdot ED}{AT}$$

The potential cancer risk and noncancer effects that may result from exposure to the combination of constituents at an area are estimated following USEPA guidance (USEPA 1989), as follows:

$$Cumulative\ Risk = \sum_i Risk_i$$

$$Hazard\ Index = \sum_i HQ_i$$

where:

$Risk_i$ = estimated cancer risk for the *i*th constituent

HQ_i = hazard quotient for the *i*th constituent

This approach may result in estimates of cumulative cancer and noncancer risks that are more conservative than necessary. For example, different chemicals may cause different and unrelated non-cancer health effects, so summing the HQs for their

individual effects would overestimate the significance of their combined effects. Nonetheless, this approach is used here as a conservative assessment tool.

The cumulative cancer risk and HI estimates for each receptor population are compared with USEPA's cancer risk limit of 10^{-4} and HI limit of 1, respectively, for determining whether corrective measures are warranted for a particular area of the Facility (61 FR 19432, May 1, 1996; USEPA 1991b). The risk estimates and results of the comparison to the USEPA-established limits are discussed in the following sections.

5.5.2 Risk Characterization for Potentially Exposed Populations

5.5.2.1 On-site Routine Workers

The significance of risks associated with potential exposure of routine workers to on-site soil, groundwater, and NAPL is discussed below.

Soil

Potential exposure of routine workers to constituents in soil at each AOI is evaluated in this risk assessment by conservatively assuming the following two hypothetical cases: (1) all soil at the AOI is outdoors and workers are exposed to the outdoor soil for the entire work day; and (2) all soil at the AOI is under an occupied building and workers are exposed to constituents in the soil via assumed vapor intrusion for the entire work day. Using these hypothetical cases is conservative and efficient because it avoids the need to prorate the work day between indoor and outdoor fractions, and risk estimates for any combination of indoor and outdoor fractions would not exceed the higher of the risk estimates for the two hypothetical cases.

The potential exposures for both hypothetical cases were first evaluated using upper-bound estimates of RME cumulative cancer and noncancer risks to streamline the risk assessment, as explained in Section 5.3.4. The initial estimates were calculated using the highest observed site-related concentrations for all constituents in soil at an area. These estimates are considered upper-bound estimates because the RME risks for an area would be lower if concentrations representative of the area were used instead of the highest observed concentrations, and if site-specific exposure factors were used to account for the magnitude, frequency, and duration of exposures appropriate for the area.

The upper-bound estimates of site-related cumulative cancer and noncancer risks were compared to USEPA's cancer risk and HI limits of 10^{-4} and 1, respectively. The upper-bound estimates of site-related cumulative cancer risk and HI for potential exposure of routine workers for both hypothetical cases (i.e., all-day exposure to outdoor soil and all-day exposure to soil constituents via vapor intrusion) based on the highest observed concentrations for all constituents in soil are summarized on Table 5.2. The table shows that the risk estimates for the following areas investigated during the RFI do not exceed the cancer risk limit of 10^{-4} or the HI limit of 1 for either hypothetical case:

- AOI 2-1 – Former UST Area A
- AOI 2-3 – Former UST Area C
- AOI 2-4 – Former UST Area D
- AOI 2-5 – Former UST Area E
- AOI 2-6 – Piston Coolant Trenches and Building
- AOI 2-7 – Former Degreaser Area
- AOI 2-8 – Former Tin Plating Area
- AOI 2-9 – Process Waste Sump
- AOI 2-10 – Former UST Area 5
- AOI 3 – Plant 7 Swarf Area
- AOI 4 – Plant 7 West Trench
- AOI 5 – Plant 7 East Trench
- AOI 6 – Dump Station and Hydromation
- AOI 8 – Railroad Spur
- AOI 9 – Waste Resin & Monlan System
- AOI 10 – Dexron System – Plant 7
- AOI 11 – Former Flexible Machining System
- AOI 12 – Dexron System – Plant 6
- AOI 13 – Plating, Degreasing and Derust Area
- AOI 14 – West Spill Containment Sump
- AOI 15 – Former Gasoline UST
- AOI 16 – Plant 3 Test Cells Spill Containment Sump
- AOI 17 – Test Cell 24 Basement
- AOI 19 – Waste Treatment
- AOI 22 – Paint Booth Sump
- AOI 23 – Dexron System – Plant 3
- AOI 24 – Metal Chips Silo
- AOI 25 – East Spill Containment Sump
- AOI 27 – Plating Wastewater Sump
- AOI 28 – Maintenance Garage USTs
- AOI 29 – Plant 3 By-products Area
- AOI 30 – Copper Strip Area
- AOI 33 – Mop Water Stations
- AOI 35 – Scrap Metal Storage Area

- AOI 36 – Drum Storage Building Area
- AOI 38 – AST Farm
- AOI 40 – Diesel Fuel Release
- AOI 45 – Swarf and Shot Peening Storage Area
- AOI 46 – Department 1207 By-products
- AOI 47 – Spill Containment Sump
- AOI 50 – Henry System
- AOI 53 – Transmission Test Assembly Area
- AOI 54 – Oil Stores/Waste Sump
- AOI 55 – Scrap Metal Collection Hoppers
- AOI 57 – Plant 12 Drum Staging Area
- AOI 60 – Hydraulic Lift Tanks
- AOI 61 – Henry System
- AOI 62 – Process Water Release Area - North
- AOI 63 – Process Water Release Area - South
- Plant 2 Perimeter
- Production Well

The estimates of cancer risk and noncancer HQ associated with background levels of metals in soil (see Section 3.5) are shown in Table 3.5.2. The estimates of risks associated with background metal concentrations are low relative to the risk limits, and are not included in the site-related risk estimates shown on Table 5.2.

As shown in Table 5.2, the upper-bound estimates of site-related cumulative cancer risk and HI exceed the cancer risk limit and/or the HI limit for the following areas:

- AOI 2-2 – Former UST Area B
- AOI 1 – Peninsula Area
- AOI 2 – Baseball Diamond Area
- AOI 26 – Oil Reclaim Building
- AOI 31 – Heat Treat Area
- AOI 32 – Department 0384 Heat Treating and Plating
- AOI 42 – Plant 14 Heat Treat Area
- AOI 43 – Cyanide/Copper Plating Area
- AOI 51 – Former Degreaser Area

For the AOIs where an upper-bound estimate of cumulative cancer risk or HI was higher than the USEPA limit, further calculations were conducted by considering appropriate ways of replacing the highest observed concentrations for the constituents that contributed most to the upper-bound estimates with concentrations that better represent the exposure concentrations for RME estimation. The results of these additional calculations are summarized on

Table 5.3. The rationale for refinement of the concentration term for each of the additional calculations for these AOIs is discussed below.

AOI 1 - Peninsula Area

The upper-bound cumulative cancer risk estimate for routine worker exposure to outdoor soil was primarily due to the maximum concentrations of benzo(a)pyrene and dibenz(a,h)anthracene. The cumulative cancer risk estimate for this scenario in Table 5.3 was calculated by replacing these maximum concentrations with 95% UCLs calculated using the highest concentrations of these constituents from any depth in each boring at AOI 1. Using the highest concentrations from any depth is still more conservative than necessary for RME estimation, because routine worker contact with these constituents would be predominantly via surface soil rather than subsurface soil.

The upper-bound HI estimate for routine worker exposure to outdoor soil was primarily due to the maximum concentrations of xylenes, manganese, and a few other metals. The HI estimate for this scenario in Table 5.3 was calculated by replacing the maximum concentrations for the metals (except mercury) with 95% UCLs calculated using the highest concentrations of these constituents in surface soil among the borings at AOI 1. Using concentrations in surface soil for these constituents is appropriate because routine worker contact with these constituents would be via surface soil. For mercury, the 95% UCL was calculated using the highest concentration from any depth in each boring at AOI 1, because routine workers could be exposed to mercury vapor from both surface and subsurface soil.

The upper-bound HI estimate for routine worker exposure to constituents in soil via vapor intrusion was primarily due to the maximum concentration of xylenes. This concentration (290 mg/kg) was from a soil sample (Sample ID DTB) that was collected in 1993 at a depth of 8.5 ft bgs prior to the RFI, and is at least 40 to 50 times higher than the xylene concentrations from the nearest soil borings which are approximately 50 ft away. The risk assessment is conservatively retaining this xylene concentration of 290 mg/kg without further refinement (e.g., 95% UCL) because no other xylene concentration is available at or around pre-RFI test pit DTB within the area that would be occupied by the hypothetical commercial/industrial building used in the vapor intrusion calculations (approximately 60 ft by 60 ft).

AOI 2 - Baseball Diamond Area

The upper-bound HI estimate for routine worker exposure to outdoor soil was primarily due to the maximum concentrations of copper and a few other metals. The HI estimate for this scenario in Table 5.3 was calculated by replacing the highest concentrations from any depth for the metals (except mercury) with the highest concentrations in surface soil for these constituents. Using concentrations in surface soil for these constituents is appropriate because routine worker contact with these constituents would be via surface soil. Using the highest concentrations in the surface soil is highly conservative and was done to streamline the risk assessment. For mercury, the highest concentration from any depth in each boring at AOI 2 was retained in the calculations, because routine workers could be exposed to mercury vapor from both surface and subsurface soil.

AOI 2-2 - Former UST Area B

The upper-bound cumulative cancer risk estimate for routine worker exposure to outdoor soil was primarily due to the maximum concentrations of benzo(a)pyrene and a few other PAHs. The cumulative cancer risk estimate for this scenario in Table 5.3 was calculated by replacing the maximum concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene with 95% UCLs calculated using the highest concentrations of these constituents from any depth in each boring at AOI 2-2. Using the highest concentrations from any depth is still more conservative than necessary for RME estimation because routine worker contact with these constituents would be predominantly via surface soil rather than subsurface soil.

AOI 26 - Oil Reclaim Building

The upper-bound cumulative cancer risk and HI estimates for routine worker exposure to constituents in soil via vapor intrusion were primarily due to the maximum concentrations of PCE and cis-1,2-DCE, respectively. These concentrations were from soil samples (Sample IDs GP125 (14-15) and SB0130 (16-18)) that were collected from below the water table. As such, they are not representative of concentrations in the vadose zone and were removed from the calculations. The cumulative cancer risk and HI estimates in Table 5.3 were calculated using the maximum concentrations of all constituents after

removing the data for these soil samples. The significance of exposure to PCE and cis-1,2-DCE concentrations in the saturated zone is evaluated using the groundwater characterization data for AOI 26.

AOI 31 - Heat Treat Area

The upper-bound HI estimate for routine worker exposure to outdoor soil was primarily due to the maximum concentrations of PCBs. The HI estimate for this scenario in Table 5.3 was calculated by replacing the maximum concentration for PCBs with a 95% UCL calculated using the highest concentration from any depth in each boring at AOI 31. Using the highest concentrations from any depth is still more conservative than necessary for RME estimation because routine worker contact with PCBs would be predominantly via surface soil rather than subsurface soil.

AOI 32 - Department 0384 Heat Treating and Plating

The upper-bound HI estimate for routine worker exposure to constituents in soil via vapor intrusion was primarily due to the maximum concentration of xylenes. This concentration was from a soil sample (Sample ID S-31223-001) that was collected in an area where GM conducted soil remediation by removing soil and then backfilling and capping the excavated areas with flowable fill and concrete to a depth of at least 3 feet. As such, this concentration of xylenes is not reasonably expected to contribute to vapor intrusion and was removed from the calculations. The HI estimate for vapor intrusion in Table 5.3 was calculated using the highest concentrations of all constituents after removing the data for this soil sample.

AOI 51 - Former Degreaser Area

The upper-bound cumulative cancer risk and HI estimates for routine worker exposure to outdoor soil and for routine worker exposure to constituents in soil via vapor intrusion were primarily due to the maximum concentration of PCE. This concentration was from a soil sample (Sample ID SB-0425 (20-22)) that was collected from below the water table. As such, it is not representative of concentrations in the vadose zone and was removed from the calculations. Likewise, the PCE concentrations from numerous other soil samples (included in Appendix G) that were collected from below the water table also are not representative of concentrations in the vadose zone and were also removed

from the calculations. The cumulative cancer risk and HI estimates in Table 5.3 were calculated by replacing the maximum concentration for PCE with a 95% UCL calculated using the highest concentrations of all constituents after removing the data for these soil samples. The significance of exposure to PCE concentrations in the saturated zone is evaluated using the groundwater characterization data for AOI 51.

As shown in Table 5.3, refinement of the concentration term reduced the upper-bound risk estimates to risk estimates that are within the acceptable limits for cumulative cancer risk and HI for AOIs 2, 2-2, 26, 31, and 32. As such, the only AOIs where potential future exposure of routine workers to soil may pose a significant risk are the following:

- AOI 1 - Peninsula Area
- AOI 32 - Department 0384 Heat Treating and Plating
- AOI 42 - Plant 14 Heat Treat Area
- AOI 43 - Cyanide/Copper Plating Area
- AOI 51 - Former Degreaser Area

As shown on Table 5.3, the potentially significant exposure to soil at these AOIs is via only vapor intrusion based on cumulative cancer risk and/or HI. Because the Facility is currently subject to OSHA regulation, the significance of potential exposure via vapor intrusion for these AOIs was also assessed using occupational inhalation limits.

The assessment of vapor intrusion risk using occupational inhalation limits was conducted by dividing each constituent's predicted indoor air concentration due to vapor intrusion by its occupational inhalation limit, and then summing the quotients or ratios for all constituents detected in the soil at each AOI. The sum of the ratios for each of these AOIs is much lower than 1, as shown on Table 5.3. This means that even though the risk assessment conservatively assumes that vapor intrusion is occurring at these AOIs, no significant occupational exposure is expected to be occurring.

Potential exposure of routine workers to lead in soil is evaluated separately from the assessment for other constituents because USEPA (2003a) evaluates the significance of lead exposures using blood lead level as an index of exposure, rather than in terms of cancer risk or noncancer HQ. USEPA's recommended range for routine worker contact with soil lead is 750 mgkg to 1,750 mg/kg, which is based on a blood lead modeling approach designed to be protective of potential

exposures to soil lead in industrial settings. As USEPA explained in promulgating the regulations at 40 CFR Part 745 (66 FR 1206, January 5, 2001), soil lead screening levels developed based on blood lead modeling should be compared with the arithmetic mean concentration of lead within the area where potential exposures are assumed to occur in order to be consistent with the principles underlying the blood lead modeling approach.

As shown in Table 5.4, the mean soil lead concentrations at all the AOIs, calculated using concentrations from the surface soil, are below the low-end of USEPA's recommended range. Therefore, no significant exposure of routine workers to soil lead is expected at any of the AOIs.

Groundwater

Routine workers are not reasonably expected to be exposed to groundwater via potable groundwater use because groundwater at the Facility is not a current or reasonably expected future drinking water supply. However, the Facility is using groundwater as non-contact cooling water, as discussed in Section 5.3.3.1. To assess the significance of potential exposure of workers via this nonpotable use, the highest observed groundwater concentration from the Facility's production wells were first compared to drinking water criteria. This comparison identified only one production well (PW-2) with any concentration higher than the drinking water criteria. As shown on Table 4.3, production well PW-2 has concentrations of cis-1,2-DCE and vinyl chloride that are higher than the MCLs. The concentration of cis-1,2-DCE is only 1.2 times higher than the MCL of 0.07 mg/L, and the concentration vinyl chloride is up to 15 times higher than the MCL of 0.002 mg/L.

The significance of the cis-1,2-DCE and vinyl chloride concentrations from PW-2 was then evaluated by considering how groundwater from PW-2 is blended with groundwater extracted from the Facility's other production wells before use. Specifically, the Facility's records for groundwater extraction from all the production wells for the past few years were reviewed to estimate the percentage of groundwater that comes from production well PW-2. These records, which are summarized in Appendix H, show that PW-2 does not contribute more than 1% of the groundwater that is blended prior to use. Based on these records of historic usage, there are no anticipated circumstances where PW-2 would be the main source of water supply for the plant for a significant duration. The only time that water would be used solely from PW-2 is during maintenance of the west loop. Typically this maintenance would be completed in a matter of days. The west loop

is the primary source of water and PW-2 is commonly used only on a limited, emergency basis during maintenance of the west loop. In addition, the water used in the distribution system is recycled throughout the process. Well water is added to the distribution system to make up the necessary volume of water needed for the different uses at the Facility. Typically well water makes up 10% to 30% of the total water usage at the Facility, with the remainder of the water being recycled water.

Based on the concentrations of cis-1,2-DCE and vinyl chloride from PW-2 and the fact that PW-2 contributes no more than 1% of the groundwater that is blended before use, the cis-1,2-DCE and vinyl chloride concentrations in the blended groundwater are expected to be well below the MCLs. As such, use of the groundwater for nonpotable purposes is not expected to pose a significant risk to the Facility's workers.

The only other potential exposure of routine workers to constituents in groundwater is via vapor intrusion. In this risk assessment, constituents in groundwater in the S1 and S2 saturated zones are assumed to volatilize and migrate through foundation cracks into the indoor air. The significance of potential exposure is conservatively evaluated using the highest observed concentrations for all constituents in S1 and S2 groundwater at each AOI. The upper-bound estimates of RME cumulative cancer and noncancer risks calculated using these concentrations are summarized on Table 5.5. The table shows that no upper-bound risk estimate exceeds the cumulative cancer risk limit of 10^{-4} or the HI limit of 1 for any area investigated during the RFI.

NAPL

As discussed in Section 5.3.3.1, routine workers could be exposed to constituents in subsurface NAPLs that volatilize and migrate through cracks in building foundations into indoor air. To assess the significance of such potential exposures, upper-bound estimates of cumulative cancer risk and HI are calculated using the highest observed concentrations of all constituents for each NAPL. As shown on Table 5.10, the upper-bound estimates for NAPL at AOIs 19 and 40 are below the cumulative cancer risk limit of 10^{-4} and HI limit of 1. NAPL was also found at AOI 31, but it had no detectable concentration of any target analyte, as discussed in Section 4.37. Therefore, potential exposure of routine workers to constituents in the NAPLs via vapor intrusion does not pose a significant risk.

5.5.2.2 On-site Maintenance Workers

The significance of potential exposure of maintenance workers to on-site soil, on-site and off-site groundwater, and NAPL is discussed below.

Soil

Potential exposure of maintenance workers to soil is evaluated using the exposure factors discussed in Section 5.3.6.2. The upper-bound estimates of site-related cumulative cancer risk and HI for potential exposure of maintenance workers to soil based on the highest observed concentrations from any depth for all constituents are summarized on Table 5.2. No onsite area has estimates that exceed the cancer risk limit of 10^{-4} or the HI limit of 1, except the upper-bound HI estimate for AOI 1.

The upper-bound HI estimate for maintenance worker exposure to soil at AOI 1 was primarily due to the maximum concentrations of manganese. The HI estimate for this scenario in Table 5.3 was calculated by replacing the maximum concentration for manganese with a 95% UCL calculated using the highest concentration from any depth in each boring at AOI 1. As shown on Table 5.3, the HI estimate calculated with the 95% UCL for manganese does not exceed the limit of 1.

Potential exposure of maintenance workers to soil lead is conservatively evaluated using the USEPA-recommended range of screening levels for routine workers, which is discussed in Section 5.5.2.1. Use of this range of screening levels for evaluating maintenance worker exposures is conservative because USEPA derived the range based on an exposure frequency (219 days/year) that is far higher than that for maintenance workers (5 days/year), even though the soil ingestion rate of maintenance workers (200 mg/day) is higher than that for routine workers (50 mg/day). As shown in Table 5.4, the mean soil lead concentrations at all the AOIs, calculated using concentrations from the surface and subsurface soil, are essentially at or below the low-end of USEPA's recommended range. Therefore, no significant exposure of maintenance workers to soil lead is expected at any of the AOIs.

Groundwater

Estimates of risks for potential exposure of maintenance workers to groundwater are calculated using the exposure factors discussed in Section 5.3.6.2. The highest detected constituent concentrations in groundwater were conservatively used as exposure concentrations for all areas to calculate upper-bound risk estimates. The upper-bound estimates of cumulative cancer risk and HI for potential exposure of maintenance workers to on-site groundwater are summarized in Table 5.5, which shows that the only upper-bound risk estimate that exceeds the cumulative cancer risk limit of 10^{-4} or the HI limit of 1 is the upper-bound HI for AOI 19.

At AOI 19, the upper-bound HI estimate for maintenance worker exposure to constituents in groundwater was primarily due to the maximum chromium (total) concentration of 46 mg/L, which was conservatively assumed in the risk calculations to consist entirely of hexavalent chromium. This concentration was from an unfiltered groundwater sample collected at monitoring well MW-11-S1 in 1995. Subsequent samples from this well had chromium (total) concentrations that range from approximately 0.16 mg/L to 1.4 mg/L. A subsequent sample from this well was also analyzed for hexavalent chromium and no hexavalent chromium was detected. As such, the chromium (total) concentration of 46 mg/L is not representative of either the total chromium or hexavalent chromium concentration at AOI 19 and was removed from the calculations. The HI estimate calculated without the chromium (total) concentration of 46 mg/L is 0.07 (Table 5.6), which indicates that maintenance worker contact with groundwater at AOI 19 poses no significant risk.

NAPL

Potential exposure of maintenance workers to NAPL and smear zone soil is evaluated using the exposure factors discussed in Section 5.3.6.2. The upper-bound estimates of cumulative cancer risk and HI for potential exposure of maintenance workers to the NAPL at AOI 19 and AOI 40 are summarized on Table 5.9, which shows that neither NAPL has upper-bound estimates that exceed the cancer risk limit of 10^{-4} or the HI limit of 1. NAPL was also found at AOI 31, but it had no detectable concentration of any target analyte, as discussed in Section 4.37.

5.5.2.3 Trespassers

Potential exposure of trespassers to soil is evaluated indirectly in this risk assessment using exposure estimates for routine workers, as explained in Section 5.3.3. This streamlines the risk assessment and is conservative because trespasser exposures would be lower than routine worker exposures. Therefore, the risk and HI estimates for trespassers are expected to be no higher than the estimates summarized in Tables 5.2 and 5.3 and discussed in Section 5.5.2.1.

5.5.2.4 Construction Workers

Potential exposure of construction workers to soil during redevelopment of Plant 2 for future commercial/industrial reuse was first evaluated using upper-bound estimates of RME cumulative cancer and noncancer risks to streamline the risk assessment, as explained in Section 5.3.4. The initial estimates were calculated using the highest observed site-related concentrations for all constituents at each area at Plant 2. The upper-bound estimates of site-related cumulative cancer risk and HI for potential exposure of construction workers to soil at Plant 2 are summarized on Table 5.2. The table shows that none of the upper-bound risk estimates exceed the cumulative cancer risk limit of 10^{-4} or the HI limit of 1, except the upper-bound HI for AOI 2-1.

For AOI 2-1, the upper-bound HI estimate for construction worker exposure to soil was primarily due to the maximum concentrations of mercury. The HI estimate for this scenario in Table 5.3 was calculated by replacing the maximum mercury concentration with a 95% UCL calculated using the highest concentration from any depth in each boring at AOI 2-1. As shown on Table 5-3, this HI estimate does not exceed 1.

5.5.2.5 Recreational Visitors

The potential exposure of recreational visitors to surface soil at AOI 2 and at the southern portion of Plant 3 is evaluated indirectly in this risk assessment using exposure estimates for routine workers, as explained in Section 5.3.3. This streamlines the risk assessment and is conservative because these types of recreational exposures are expected to be lower than routine worker exposures. Therefore, the risk and HI estimates for recreational visitors are expected to be no higher than the estimates for AOI 2 and the AOIs that form the southern portion of Plant 3, which are summarized in Tables 5.2 and 5.3 and discussed in Section 5.5.2.1.

5.5.2.6 Off-Site Residents and Workers

Potential exposure of off-site residents and workers to constituents in on-site soil via windblown dust and vapors is evaluated indirectly in this risk assessment using exposure estimates for on-site routine workers, as explained in Section 5.3.3. This streamlines the risk assessment and is conservative because these types of off-site residential and worker exposures would be lower than on-site routine worker exposures. Therefore, the risk and HI estimates for off-site residential and worker exposures via windblown dust and vapors are expected to be no higher than the estimates for on-site routine workers, which are summarized on Tables 5.2 and 5.3 and discussed in Section 5.5.2.1.

Potential exposure of off-site residents and workers to constituents in groundwater via vapor intrusion are conservatively estimated using the highest observed concentrations in on-site groundwater, as discussed in Section 5.3.3. This streamlines the risk assessment and is conservative because on-site groundwater concentrations are higher than off-site groundwater concentrations, as discussed in Section 4. The cumulative cancer risk and HI estimates based on these on-site concentrations are considered upper-bound estimates for off-site exposures. Table 5.5 summarizes these upper-bound estimates, which are all below the cumulative cancer risk limit of 10^{-4} and HI limit of 1.

Similarly, potential exposure of off-site residents and workers to constituents in on-site NAPL that may extend under off-site buildings in the future is conservatively estimated using on-site NAPL concentrations. Table 5.10 summarizes the upper-bound cumulative cancer risk and HI estimates for the two on-site NAPLs with detected target analytes (at AOI 19 and AOI 40), which are all below the cumulative cancer risk limit of 10^{-4} and HI limit of 1.

Potential exposure of off-site maintenance workers to groundwater is evaluated indirectly in this risk assessment using exposure estimates for on-site maintenance workers, as explained in Section 5.3.3. This streamlines the risk assessment and is conservative because on-site groundwater concentrations are higher than off-site groundwater concentrations. Therefore, the risk and HI estimates for off-site maintenance workers are expected to be no higher than the estimates summarized in Table 5.5 and discussed in Section 5.5.2.2.

5.5.2.7 Off-Site Recreational Visitors

Potential exposure of off-site recreational visitors to constituents in groundwater via groundwater discharge to Big Eagle Creek is evaluated by estimating hypothetical upper-bound surface water concentrations for constituents in on-site groundwater in the S1 and S2 units that discharges to the Creek and comparing these estimated concentrations to ambient water quality criteria. To streamline this evaluation, the most recent concentration of each constituent at each groundwater monitoring well in the S1 and S2 units was first compared to drinking water criteria and ambient water quality criteria to identify the groundwater constituents that warrant further evaluation. The constituents with the most-recent groundwater concentrations from each monitoring well in S1 and S2 that exceed drinking water criteria and ambient water quality criteria are summarized on Table 5.7.

Each concentration on Table 5.7 is assumed to represent the concentration in groundwater that discharges to the Creek. This assumption is considered a hypothetical upper-bound assumption because this concentration greatly overestimates the average groundwater concentration along the approximately 6,000 ft bank of Big Eagle Creek that is downgradient of the Facility. Although such an average concentrations would provide a more accurate basis for estimating actual mass-loading to the Creek, estimating such concentrations (which would involve additional assumptions and would be time-consuming) was not necessary because the groundwater concentrations on Table 5.7 are relatively low and the discharge of groundwater is low relative to flow in the Creek.

As discussed in Appendix E, the groundwater discharge rate is approximately 0.007 of the Creek's harmonic mean flow rate. This means the surface water concentrations in the Creek due to groundwater discharge from the Facility would be approximately 0.007 of the concentrations in groundwater. Specifically, multiplying the groundwater concentrations in Table 5.7 by 0.007 gives a hypothetical upper-bound estimate of the surface water concentrations due to groundwater discharge from the Facility. The estimated surface water concentration for each groundwater concentration listed on Table 5.7 is shown on Table 5.8 and compared to the ambient water quality criterion for the protection of human health. As shown on Table 5.8, the hypothetical upper-bound estimates of surface water concentrations for all constituents are lower than the ambient water quality criteria, except for benzene at MW-0414-S2 in AOI 32, 1,1-dichloroethene at MW2-4-S2 at Plant 2 Perimeter, chromium (total) at MW-3-S2 in AOI 2-4, and iron at MW-11-S1 in AOI 19, where the estimated surface water concentrations exceed the ambient water quality criteria by at most a factor of 1.9.

Estimated surface water concentrations less than the ambient water quality criteria indicate that groundwater underlying the Facility may discharge to the Creek without causing an adverse effect on recreational use, even under the hypothetical upper-bound assumptions which are discussed in Appendix E. The significance of the hypothetical upper-bound estimates of surface water concentrations that exceed the criteria are discussed below.

Benzene at MW-0414-S2

The upper-bound estimate of benzene concentration in surface water exceeds the criterion by a factor of 1.1, when it is assumed that the benzene concentration at monitoring well MW-0414-S2 represents the benzene groundwater concentration along the Facility's entire 6,000-ft bank of Big Eagle Creek. However, the benzene groundwater concentration at MW-0414-S2 is actually bounded laterally to within a distance of approximately 350 feet by monitoring wells MW-0632-S2 and MW-0629-S2 as shown on Figure 4.36.3. This distance is only 0.058 of the 6,000 ft bank. This means the hypothetical upper-bound estimate of the surface water concentration due to this benzene groundwater concentration should be no more than 0.058 of the estimate in Table 5.8, and would be well below the ambient water quality criterion.

1,1-Dichloroethene at MW2-4-S2

The upper-bound estimate of 1,1-dichloroethene concentration in surface water exceeds the criterion by a factor of 1.9, when it is assumed that the 1,1-dichloroethene concentration at monitoring well MW2-4-S2 represents the 1,1-dichloroethene groundwater concentration along the Facility's entire 6,000-ft bank of Big Eagle Creek. However, the 1,1-dichloroethene groundwater concentration at MW2-4-S2, located at the upgradient perimeter of Plant 2 in an area not believed to have been affected by Facility operations. This indicates that the concentration appears to have originated from an upgradient source unrelated to the Facility. In addition, monitoring well MW2-4-S2 is actually bounded laterally to within a distance of approximately 200 feet by monitoring wells MW-0645-S2 and MW-0615-S2 as shown on Figure 4.6.1. This distance is only 0.033 of the 6,000 ft bank. This means the hypothetical upper-bound estimate of the surface water concentration due to this 1,1-dichloroethene groundwater concentration, even if it is assumed that it is related to the Facility rather than an upgradient source, should be no more than 0.033 of the estimate in Table 5.8, and would be well below the ambient water quality criterion.

Chromium at MW-3-S2

The upper-bound estimate of chromium (total) concentration in surface water exceeds the criterion by a factor of 1.9, when it is assumed that the chromium (total) concentration at monitoring well MW-3-S2 represents the chromium (total) groundwater concentration along the Facility's entire 6,000-ft bank of Big Eagle Creek. The chromium (total) groundwater concentration at MW-3-S2 is from a sample collected in 1999, and MW-3-S2 was not resampled during the RFI because it was abandoned and replaced during the RFI by monitoring well MW-0616-S2. The RFI data from MW-0616-S2 was non-detect for chromium (total). This means the hypothetical upper-bound estimate of the surface water concentration due to this chromium (total) groundwater concentration should be non-detect.

Iron at MW-11-S1

The upper-bound estimate of iron concentration in surface water exceeds the criterion by a factor of 1.2, when it is assumed that the iron concentration at monitoring well MW-11-S1 represents the iron groundwater concentration along the Facility's entire 6,000-ft bank of Big Eagle Creek. However, the iron groundwater concentration at MW-11-S1 was collected in 1995 during a pre-RFI sampling event. During the RFI it was determined that iron was not a site-related contaminant and was therefore removed from the list of constituents being analyzed during the RFI.

In summary, when the lateral extent of the current, site-related groundwater concentrations at these monitoring wells are considered, as opposed to assuming each concentration is representative of the entire 6,000-ft bank of Big Eagle Creek, the estimate of surface water concentrations due to groundwater concentrations are below the ambient water quality criteria. This indicates that groundwater underlying the Facility may discharge to the Creek without causing an adverse effect on recreational use.

As noted in Section 5.3.3, recreational visitors could contact the NAPL sheen in the boomed area on the bank of Big Eagle Creek. The significance of this potential exposure is indirectly evaluated using the risk estimates for maintenance worker contact with NAPL (specifically the NAPL from AOI 40). This indirect approach streamlines the risk assessment and is expected to be conservative since recreational visitor contact with the NAPL sheen is expected to be infrequent, if at all, and the NAPL

sheen likely would not cover the skin surface area assumed for NAPL contact by maintenance workers. Therefore, the risk and HI estimates for recreational visitors are expected to be no higher than the estimate for maintenance worker contact with NAPL at AOI 40, which is summarized on Table 5.9 and discussed in Section 5.5.2.2.

5.5.3 Uncertainty Analysis

5.5.3.1 Exposure Concentrations

As discussed in Section 5.3.4, most exposure concentrations for soil in this risk assessment are based on the highest concentrations detected in soil at each area, and 95% UCLs are calculated only when an upper-bound estimate of the RME cumulative cancer risk or HI exceeds the cancer risk limit of 10^{-4} or the HI limit of 1, respectively. This approach streamlines the risk assessment by avoiding calculation of 95% UCLs that would not materially affect risk assessment conclusions regarding the need for interim and/or corrective measures.

However, this approach inflates the cumulative cancer risk and HI estimates that do not exceed 10^{-4} and 1, respectively, since these estimates are entirely based on maximum concentrations. As explained in Section 5.3.4, the use of maximum concentrations for all constituents introduces more conservatism than necessary for RME estimates because it assumes simultaneous worst-case exposure to all constituents constantly, when the RME generally would not have all constituents at worst-case concentrations at all times. The inflation of these risk and HI estimates makes them closer to the cumulative cancer risk limit of 10^{-4} and the HI limit of 1 than they would be if 95% UCLs were used for all constituents.

The above discussion regarding soil exposure concentrations also applies to groundwater exposure concentrations for the excavation scenario, since construction workers would not be expected to contact groundwater with the maximum concentrations of every constituent during every on- and off-site excavation.

For the groundwater vapor intrusion scenarios, the use of maximum concentrations also overstates the RME risk. This is because the groundwater under an individual on-site or off-site building is unlikely to have the maximum concentrations of all constituents. However, these upper-bound estimates can be useful for identifying constituents for which significant risk is possible, so that risk-based concentration limits for such constituents can be used to identify specific locations where significant exposures might occur.

Most exposure concentrations that are based on mathematical modeling of constituent transfer from soil or groundwater to air are conservative for the same reasons discussed above, since the model estimates are based on the use of maximum concentrations in soil or groundwater. In addition, the model estimates are conservative because they generally do not account for the reduction of constituent concentrations in the soil or groundwater as constituents transfer from these media. As a result, risk estimates that are based on the sum of risk estimates for multiple media are more conservative than necessary for RME estimates. These include almost all of the risk estimates discussed in Section 5.5.

5.5.3.2 Exposure Factors

As discussed in Section 5.3.6, most of the exposure factors used in the risk assessment are high-end (i.e., 90th to 95th percentile) estimates of the magnitude, frequency, and duration of potential exposures. When several such high-end factors are multiplied, the resulting estimates of dose will be higher than the 90th percentile of the distribution of exposures in the potentially exposed population and could be higher than the exposure to the maximally exposed individual, particularly when such exposure factors are combined with exposure concentrations that are based on maximum concentrations.

Also, the use of generic default exposure factors for evaluation of potential exposure of workers to soil is more conservative than necessary for RME estimates, which allow the use of site-specific considerations (USEPA 1989). For example, the "fraction contacted" terms used in this evaluation assume that routine workers are exposed to soil for an entire work day at each area, but workers at commercial/industrial sites generally spend only a part of the work day at a particular part of the Site.

The ingestion rate for estimating exposure of maintenance workers and construction workers to soil in this risk assessment is 200 mg/day. As noted in Section 5.3.6.2, this ingestion rate is based on USEPA-compiled soil-to-hand adherence data for construction-related activities (USEPA 1997b), and is believed to be plausible, conservative, and consistent with the expectation that incidental soil ingestion is associated primarily with hand-to-mouth contact. More recently, USEPA guidance (2003b) recommends an ingestion rate of 330 mg/day that is based on the variability in the data from a single soil ingestion study that involved a very small number of individuals. This ingestion rate was not used in the risk calculations discussed in Section 5.5.2.2 because it is based on very limited data that might not be appropriate

for representing actual exposure. However, using the somewhat higher ingestion rate of 330 mg/day would not alter the conclusions of the risk assessment.

5.5.3.3 Extrapolated Toxicity Values

As discussed in Section 5.4.3, the dermal toxicity values used in the risk assessment are oral toxicity values that were extrapolated to the dermal route without chemical-specific judgment regarding whether such extrapolation might be appropriate for a particular chemical. This is a conservative approach to ensure that potential risk via the dermal route is not overlooked. However, some constituents might exhibit different degrees of toxicity for the dermal route relative to the oral route. For such constituents, the extrapolation approach used in the risk evaluation could introduce uncertainty.

The conversion of an oral toxicity value to an inhalation toxicity value generally should be justified by consideration of a number of factors, including point of entry effects, pharmacokinetic data on the chemical's behavior in the different routes of exposure, and differences in the target organs affected. However, as a conservative measure for constituents without any inhalation toxicity values, oral SFs and RfDs were converted to inhalation URFs and RfCs in this risk assessment. Use of these extrapolated inhalation toxicity values reduces the potential for underestimating inhalation risks, but could introduce uncertainty.

5.5.3.4 Risk Characterization

The summation of cancer risks and HQs for multiple constituents, as described in Section 5.5.1, is based on USEPA guidance (1989) to assume dose additivity, which means that constituents in a mixture are assumed to have no synergistic or antagonistic interactions and each constituent has the same mode of action and elicits the same health effects. In general, this approach can introduce significant uncertainty. However, the majority of the cumulative cancer risk and HI estimates in this risk assessment are dominated by contributions from no more than a few constituents, so that the cumulative risk estimates are nearly the same as those for the few key constituents.

5.6 Summary and Conclusions

The significance of potential exposures to site-related concentrations of constituents in soil, groundwater, NAPL, and smear zone soil is evaluated based on conservative estimates of RME under current and reasonably expected future land use at and

around the Facility. The evaluation uses the RFI data that were discussed in Section 4 and methods that are consistent with USEPA risk assessment guidance. The significance of potential exposures is determined by comparing estimates of site-related cumulative cancer and noncancer risks with a cancer risk limit of 10^{-4} and a HI limit of 1, respectively, which USEPA has established as triggers for corrective measures under RCRA corrective action (USEPA 1991b).

Based on consideration of current and reasonably expected land use at and around the Facility, the potentially exposed populations considered in this risk assessment include the following:

On-Site: Routine workers
Maintenance workers
Trespassers
Construction workers
Recreational visitors

Off-Site: Residents
Routine workers
Maintenance workers
Recreational visitors

The potential exposures evaluated for these receptors are summarized in the conceptual site model shown in Table 5.1. Results of the evaluation are summarized below for each receptor population.

Routine Workers

The risk assessment evaluated potential outdoor exposures to soil at the Facility via incidental ingestion, dermal contact, and inhalation of vapors and particulates. Indoor exposure via inhalation of soil, groundwater, and NAPL constituents assuming that they volatilize and migrate through cracks in building foundations was also evaluated. Potential exposure via nonpotable use (i.e., non-contact cooling) of groundwater from production wells was also evaluated.

The conservative estimates of site-related cumulative cancer risk and HI do not exceed the cancer risk limit of 10^{-4} and the HI limit of 1, respectively, at any of the areas except potentially AOIs 1, 32, 42, 43, and 51 for vapor intrusion from soil. However, as discussed in Section 1.2.3, the Facility is subject to OSHA regulation and there is no significant current exposure at any of these areas via vapor intrusion based on occupational inhalation limits. The mean lead concentrations in surface soil (0 to 2 ft bgs) are below the range of soil lead criteria for routine

workers. Therefore, constituent concentrations in soil, groundwater, and NAPL do not currently pose a significant risk to routine workers via either outdoor or indoor exposures.

The risk assessment evaluated potential exposures via nonpotable groundwater use by using drinking water criteria as a conservative and streamlined approach since only one production well (PW-2) has groundwater concentrations higher than the drinking water criteria and these concentrations are only slightly higher. In fact, groundwater from this production well (PW-2) is blended with groundwater extracted from the Facility's other production wells before use and contributes less than 1% of the blended groundwater. Therefore, the blended groundwater does not have concentrations that exceed drinking water criteria and current use of the blended groundwater for nonpotable purposes does not pose a significant risk to the Facility's workers.

Maintenance Workers

The risk assessment evaluated the significance of potential exposures to soil, groundwater, NAPL, and smear zone soil during occasional subsurface construction/maintenance activities.

The conservative estimates of site-related cumulative cancer risk and HI for potential exposure to soil do not exceed the cancer risk limit of 10^{-4} and the HI limit of 1, respectively, at any of the areas. The mean lead concentrations in deep soil do not exceed the range of soil lead criteria for routine workers, which are also appropriate for maintenance workers (Section 5.5.2.2). Therefore, constituent concentrations in soil do not pose a significant risk to maintenance workers.

Potential exposures to smear zone soil and NAPL during excavations at areas with NAPL were evaluated in addition to other soil exposures. The risk assessment evaluated the significance of potential exposures to smear zone soil and NAPL via incidental ingestion of smear zone soil, dermal contact with smear zone soil and NAPL, and inhalation of NAPL vapors. The estimates of cumulative cancer risk and HI for this scenario do not exceed the cancer risk limit of 10^{-4} or the HI limit of 1, respectively, for exposure to smear zone soil or NAPL. Currently, maintenance activities at the Facility are governed by health and safety protocols that would prevent any significant exposure during subsurface construction activities, including situations that would involve contact with the NAPL. Therefore,

constituent concentrations in NAPL and smear zone soil do not pose a significant risk to maintenance workers.

The risk assessment also evaluated the significance of potential exposures to constituents in groundwater via incidental ingestion, dermal contact, and vapor inhalation. The conservative estimates of cumulative cancer risk and HI do not exceed the cancer risk limit of 10^{-4} or the HI limit of 1, respectively. Therefore, constituent concentrations in groundwater do not pose a significant risk to construction workers.

Trespassers

The risk assessment evaluated the significance of potential outdoor exposures of trespassers to soil by using the risk estimates for routine workers outdoor exposures to soil, which is a conservative and streamlined approach. Since the constituents in soil do not pose a significant risk to routine workers via outdoor exposures, they do not pose a significant risk to trespassers.

Construction Workers

The risk assessment evaluated the significance of potential exposures to soil during redevelopment of Plant 2 for future commercial/industrial reuse.

The conservative estimates of site-related cumulative cancer risk and HI for potential exposure to soil do not exceed the cancer risk limit of 10^{-4} and the HI limit of 1, respectively, for any area at Plant 2. Therefore, constituent concentrations in soil do not pose a significant risk to construction workers.

Recreational Visitors

The risk assessment evaluated the significance of potential exposures of recreational visitors to soil at AOI 2 and the AOIs that form the southern portion of Plant 3 by using the risk estimates for routine workers outdoor exposures to soil, which is a conservative and streamlined approach. Since the constituents in soil do not pose a significant risk to routine workers via outdoor exposures, they do not pose a significant risk to recreational visitors at these AOIs.

The risk assessment also evaluated potential exposure of off-site recreational visitors to constituents in groundwater via groundwater discharge to Big Eagle

Creek. The highly conservative estimates of the surface water concentrations of constituents that discharge from on-site groundwater in the S1 and S2 units into the Creek are lower than the ambient water quality criteria. Therefore, constituent concentrations in groundwater that could discharge to surface water do not pose a significant risk to off-site recreational visitors.

Off-Site Residents and Workers

The risk assessment evaluated the significance of potential exposures of off-site residents and workers to constituents in on-site soil via windblown dust and vapors indirectly using risk estimates for on-site routine workers, which is a conservative and streamlined approach. Since the constituents in soil do not pose a significant risk to routine workers via outdoor exposures, they do not pose a significant risk to off-site residents or workers.

The risk assessment evaluated the significance of potential vapor intrusion exposures of off-site residents and workers to constituents in groundwater and NAPL indirectly using the highest detected concentrations on-site, which is a conservative and streamlined approach. The conservative estimates of cumulative cancer risk and HI do not exceed the cancer risk limit of 10^{-4} or the HI limit of 1, respectively. Therefore, constituent concentrations in groundwater and NAPL do not pose a significant risk to off-site residents or workers.

The risk assessment evaluated the significance of potential exposures of off-site maintenance workers to constituents in groundwater indirectly using risk estimates for on-site maintenance workers, which is a conservative and streamlined approach. Since the constituents in groundwater do not pose a significant risk to on-site maintenance workers, they do not pose a significant risk to off-site maintenance workers.

In conclusion, the risk assessment determined that current potential exposures to constituents in soil, groundwater, NAPL, and smear zone soil do not pose a significant risk. It also determined that future potential exposures to constituents in these media do not pose a significant risk, except potentially via soil vapor intrusion at AOIs 1, 32, 42, 43, and 51.

6 Ecological Risk Evaluation

6.1 Introduction

The initial steps in the ecological risk evaluation for the Allison Transmission Facility were to conduct an ecological habitat characterization and to develop a preliminary conceptual site model (Exponent 2005). The results of those evaluations are presented in Appendix F. The habitat characterization identified only three AOIs at the Facility where the potential exists for risk to ecological receptors due to the presence of suitable habitat and potentially complete exposure pathways. These included two aquatic habitats, Big Eagle Creek (AOI 58) and Little Eagle Creek (AOI 59) and one terrestrial habitat, the Peninsula Area (AOI 1). At the time of preparation of the ecological habitat characterization there was incomplete information on the extent of releases, if any, to these AOIs, and all were retained for possible further evaluation if warranted based on results of subsequent sampling conducted as part of the RFI. Therefore, this section presents an update on the ecological habitat characterization and evaluates risk to ecological receptors in these three AOIs.

6.2 Ecological Evaluation of Big Eagle Creek and Little Eagle Creek

As part of the RFI investigation, an evaluation of sediment and surface water in Big Eagle Creek and Little Eagle Creek was conducted. The purpose of the investigation was to (1) characterize the presence and distribution of metals, base-neutrals, and PCBs in sediments and surface water of these AOIs, and (2) determine whether concentrations in sediment adjacent to the Facility are significantly elevated compared with concentrations upstream of the Facility.

The complete details of that investigation are presented in Sections 4.55 and 4.56 for Big Eagle Creek and Little Eagle Creek, respectively. In brief, statistical comparisons of sediment concentrations of detected chemicals in reaches of the creeks adjacent to the Facility to the associated upstream reach sample concentrations indicated no clear evidence of impact from the Facility, as *P*-values for all comparisons were greater than 0.01. Beryllium (in Big Eagle Creek and Little Eagle Creek) and lead (Little Eagle Creek only) had *P*-values between 0.01 and 0.05. A review of the spatial distribution of these metals showed no apparent trend or pattern that would indicate the higher concentrations in these data sets were attributable to the Facility.

The only chemicals detected in surface water samples from Big Eagle Creek were bis[2-chloroethyl]ether, dimethyl phthalate, and manganese. The sporadic

occurrences and low concentrations of the two organic compounds in surface water and other matrices sampled during the RFI, indicated that they were unlikely to be attributable to the Facility. The manganese concentrations in the surface water samples spanned a narrow range of low concentrations that were likely due to natural occurrence. The absence of a statistically significant difference in sediment manganese concentrations between reaches provided further indication that manganese in the surface water samples was unlikely attributable to the Facility.

The findings of the sediment and surface water evaluation indicated that there are no discernible patterns of chemical concentrations in Big Eagle Creek or Little Eagle Creek to indicate that detected substances were attributable to the Facility. Therefore, exposure pathways from the Facility to ecological receptors in these two creeks are incomplete, indicating that no further evaluation of risk to receptors is required.

6.3 Ecological Evaluation of the Peninsula Area

The Peninsula Area (AOI 1) was tentatively retained for further evaluation in the ecological habitat characterization because several soil borings taken in 2004 had indicated that the spatial extent of metals and BNs in soil might not have been sufficiently characterized. The habitat characterization concluded that further evaluation could be needed if additional RFI sampling indicated that releases had occurred to the wooded areas of the AOI, which were identified as areas providing suitable ecological habitat.

Three locations within the wooded area were sampled during Phase III of the RFI to determine whether releases had occurred in the wooded area, these being SB-01-0706, SB-01-0708, and SB-01-0709 (Drawings 4.11.1 and 4.11.2). Soil borings were collected and sampled for metals and BNs. For the ecological screening evaluation to determine whether releases to the wooded area had occurred, chemical concentrations in the surface soil layer (0-2 ft) are considered. The chemicals detected in this soil interval included a number of metals and fluoranthene and pyrene (at SB-01-0709 only). Detected chemicals were compared with EPA Region 5 Ecological Screening Levels (ESLs, www.epa.gov/reg5rcra/ca/ESL.pdf). All metal concentrations exceed their ESLs, except for nickel and arsenic (at SB-01-0706 only). Neither of the BNs detected at SB-01-0709 exceed the ESL (Table 6.1). Metal concentrations were also compared to Ecological Soil Screening Levels (Eco-SSLs) developed by EPA (www.epa.gov/ecotox/ecossl/). EPA notes that these numbers were derived to avoid underestimating risk. Eco-SSLs have been developed for plants, soil invertebrates, birds, and mammals. For each metal with more than one Eco-SSL the lowest value

was selected. Only lead and vanadium exceed respective Eco-SSLs and in both cases the maximum exceedance is only about two-fold (Table 6.1). Site-specific background soil levels were also calculated as part of the RFI. As shown in Table 6.1, neither lead or vanadium concentrations at AOI 1 are higher than site-specific background concentrations.

The findings of the RFI soil investigation indicate that only lead and vanadium exceed nationally recognized soil screening levels. Additionally, neither of these metals, nor any of the other detected metals exceed their respective site-specific background levels, 95% UCLs discussed in Section 3.5, indicating that there are no patterns or trends attributable to the Facility. Therefore, exposure pathways from the Facility to ecological receptors in AOI 1 are incomplete, indicating that no further evaluation of risk to receptors is required in this area.

6.4 Conclusion

The ecological habitat characterization for the Facility identified two aquatic habitats (AOI 58 and 59) and one terrestrial habitat (AOI 1) that are suitable for ecological receptors and that could potentially have complete exposure pathways to chemical releases at the Facility. Subsequent investigations conducted as part of the RFI indicate that in all these areas the pathways are incomplete as there is no evidence of patterns of elevated chemical concentrations attributable to the Facility. Therefore, because exposure pathways are incomplete, the likelihood of unacceptable levels of risk to ecological receptors in these habitats is considered negligible, and no further ecological evaluation of the Facility is necessary.

7 Summary and Conclusions

The Description of Current Conditions (DOCC) report (ARCADIS 2005a) evaluated 72 AOIs and determined that 58 AOIs warranted further investigation in the RFI. The rationale for this determination was discussed in the DOCC. During the RFI field investigation, three additional AOIs (AOI 63, Plant 2 Perimeter, and Production Well) were identified as warranting field investigation. Therefore, the RFI field investigation included 61 AOIs.

The objective of the RFI field investigation was to determine whether a significant release of hazardous constituents to the environment has occurred from the AOIs being investigated. Based on the results of the initial phase of the RFI field investigation, two additional phases of field investigation were conducted to characterize the nature and extent of the releases found during the initial field phase. The findings from the first two phases of investigation were provided to USEPA (ARCADIS 2006b, 2007b) and reviewed with USEPA to determine the scope of the next phase of field investigation. The findings from all three phases of the RFI field investigation (including Phase III), are discussed in Section 4 of this RFI Report.

A human health risk assessment was conducted to evaluate the health significance of site-related constituent concentrations at all AOIs where soil, groundwater, and NAPL data were collected during the RFI field investigation. The purpose of the risk assessment is to determine whether any of the site-related concentrations at each AOI poses a potentially significant risk under reasonable maximum exposure based on current and reasonably expected future land use which would warrant corrective measures. The human health risk assessment and its results are discussed in Section 5 of this RFI Report. An ecological risk evaluation and its results are discussed in Section 6 of this RFI Report. Recommendations for interim or corrective measures at areas where a potentially significant risk was identified in the human health risk assessment are discussed in Section 7.2.

7.1 No Significant Risk Identified

Among the areas investigated during the RFI, the following areas have no potentially significant risk from current or future exposure to hazardous constituents in soil, groundwater, NAPL, or smear zone soil. The determination is based on the risk evaluations discussed in Section 5 and Section 6:

- AOI 2-1 – Former UST Area A
- AOI 2-2 – Former UST Area B

- AOI 2-3 – Former UST Area C
- AOI 2-4 – Former UST Area D
- AOI 2-5 – Former UST Area E
- AOI 2-6 – Piston Coolant Trenches and Building
- AOI 2-7 – Former Degreaser Area
- AOI 2-8 – Former Tin Plating Area
- AOI 2-9 – Process Waste Sump
- AOI 2-10 – Former UST Area 5
- AOI 2 – Baseball Diamond Area
- AOI 3 – Plant 7 Swarf Area
- AOI 4 – Plant 7 West Trench
- AOI 5 – Plant 7 East Trench
- AOI 6 – Dump Station and Hydromation
- AOI 8 – Railroad Spur
- AOI 9 – Waste Resin & Monlan System
- AOI 10 – Dexron System – Plant 7
- AOI 11 – Former Flexible Machining System
- AOI 12 – Dexron System – Plant 6
- AOI 13 – Plating, Degreasing and Derust Area
- AOI 14 – West Spill Containment Sump
- AOI 15 – Former Gasoline UST
- AOI 16 – Plant 3 Test Cells Spill Containment Sump
- AOI 17 – Test Cell 24 Basement
- AOI 19 – Waste Treatment
- AOI 22 – Paint Booth Sump
- AOI 23 – Dexron System – Plant 3
- AOI 24 – Metal Chips Silo
- AOI 25 – East Spill Containment Sump
- AOI 26 – Oil Reclaim Building
- AOI 27 – Plating Wastewater Sump
- AOI 28 – Maintenance Garage USTs
- AOI 29 – Plant 3 By-products Area
- AOI 30 – Copper Strip Area
- AOI 31 – Heat Treat Area
- AOI 33 – Mop Water Stations
- AOI 35 – Scrap Metal Storage Area
- AOI 36 – Drum Storage Building Area
- AOI 38 – AST Farm
- AOI 40 – Diesel Fuel Release
- AOI 45 – Swarf and Shot Peening Storage Area
- AOI 46 – Department 1207 By-products
- AOI 47 – Spill Containment Sump
- AOI 50 – Henry System
- AOI 53 – Transmission Test Assembly Area
- AOI 54 – Oil Stores/Waste Sump

- AOI 55 – Scrap Metal Collection Hoppers
- AOI 57 – Plant 12 Drum Staging Area
- AOI 60 – Hydraulic Lift Tanks
- AOI 61 – Henry System
- AOI 62 – Process Water Release Area - North
- AOI 63 – Process Water Release Area - South
- Plant 2 Perimeter

The RFI findings indicate that no further investigation of or corrective measures at these areas are warranted.

7.2 Potentially Significant Future Risks Identified

Based on the findings and conclusions of the human health risk assessment and the ecological risk evaluation of the RFI, there is currently no potentially significant risk from exposure to hazardous constituents in soil, groundwater, or NAPL at the Facility. However, GM plans to evaluate potential options for interim or corrective measures to address the following potentially significant risk under reasonably expected future land use at the Facility:

- Risk estimates exceeded USEPA's limits at AOIs 1, 32, 42, 43, and 51 for potential exposure via vapor intrusion from soil into a hypothetical commercial/industrial building that is not subject to OSHA regulation. Options for corrective measures will be evaluated as part of the CMP.

- Continued operation of the existing SVE System at AOI 51 and existing groundwater remediation systems at AOIs 40 and 51 will be evaluated as part of the CMP.

- The concentrations of cis-1,2-DCE and vinyl chloride at production well PW-2 exceed MCLs. The development of allowable limits for the concentrations of these VOCs from PW-2 will be evaluated as part of the CMP.

7.3 Additional Activities

GM also plans to complete the following activities to address certain conditions, even though the human health risk assessment determined that these conditions do not pose a potentially significant risk under either current or reasonably expected future land use at the Facility:

- To facilitate redevelopment of the Plant 2 property for commercial/industrial reuse, options for removal of mercury in soil at AOI 2-1 will be evaluated.

- To facilitate redevelopment of the Plant 2 property for commercial/industrial reuse, PAHs in soil at AOI 2-2 will be further evaluated.

- An interim measure is planned to address NAPL, which contains PCBs, in monitoring well MW-0413-S1 at AOI 19. The interim measures work plan was submitted to USEPA on October 13, 2006 and the interim measure is in the process of being installed as discussed in Section 1.3.1.

- To continue operation of the Diesel Fuel Plume Groundwater Recovery System (AOI 40).

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Appendix A

Supplemental Plant 2 Information

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Appendix B

Boring Logs and Monitoring Well Construction Diagrams

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Appendix C

Laboratory Analytical Reports and Validation Summaries

Summary Tables for Data Prior to and During the RFI

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Appendix D

Evaluation of Creek Sediment and Surface Water

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Appendix E

Human Health Risk Assessment
Supporting Information and
Calculations

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Appendix F

Ecological Habitat Characterization and Preliminary Conceptual Site Model

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Appendix G

PCE Concentrations in Shallow Soils at AOI 51

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Appendix H

Connectivity of Production Well PW-2-S3 to Sand Units

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Appendix I

Analytical Data Reports for Off-Site Residential Water Wells Sampled by the Marion County Health Department